General Science





Grade 8



Teacher's Guide

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Table of Contents

UNIT ONE

BASICS OF SCIENTIFIC INVESTIGATION.....1

1.1 Scientific Measurements 2

1.2 Doing Scientific Investigation 12

UNIT TWO

THE COMPOSITION OF MATTER..... 23

2.1 Early Thinking about the Composition of Matter.....24

2.2 Inside of an Atom.....27

2.3 Molecules.....32

UNIT THREE

CLASSIFICATION OF COMPOUNDS..... 36

3.1 Introduction.....37

3.2 Organic Compounds.....40

3.3 Inorganic Compounds.....45

3.4 Neutralization Reaction and Salts.....61

UNIT FOUR

HUMAN BODY SYSTEMS AND HEALTH.....67

4.1 INTEGUMENTARY SYSTEMS.....69

4.2 Muscular system.....73

4.3. Skeletal System.....78

4.4. Digestive system.....81

4.5 Respiratory system.....84

4.6 Circulatory system.....88

4.7 Reproductive system.....90

UNIT FIVE

ECOSYSTEM AND CONSERVATION OF NATURAL RESOURCES.....95

5.1 Definition and Components of ecosystem.....97

5.2. Conservation of Natural Resources.....105

UNIT SIX

THE SOLAR SYSTEM.....115

6.1 Family of the Solar System.....116

6.2 Formation of the Solar System.....120

6.3 Earth in Comparison with Solar System.....122

6.4 Our planet's suitability for life (uniqueness).....124

UNIT SEVEN

PHYSICAL PHENOMENA IN THE SURROUNDING.....130

7.1 Phenomena of Light.....133

7.2 Vision and Imaging.....136

7.3 Sound.....138

7.4 Heat.....141

7.5 Simple Circuit.....143

7.6 Magnetism.....145

Syllabus.....156

Instructions to use this Teacher's Guide

The new syllabus of the ministry of education of the Federal Democratic Republic of Ethiopia, for the subject of General Science for grades 7 and 8 is going to be implemented from the year 2014 E.C. From then onwards, the teachers will use this teachers' guide. The syllabus is included in the teachers' guide to make the process easy for the students.

This teachers' guide consists of a compilation of instructions given to the teachers to make use of in the classroom to achieve specific competencies. Further, the specific competencies thus highlighted are included in the teachers' guide with time suggested for each of the topics.

Learning outcomes to be achieved at the end of each lesson are mentioned clearly in the teachers' guide and it is expected that the teachers will be guided to arrive at a comprehensive conclusion on the behavioral changes expected of the children based on the three domains, knowledge, attitudes and skills.

The teachers' guide also includes the basic concepts and essential technical terms the students are expected to acquire. Whether the students have achieved expected competencies has to be determined by way of assessment and evaluation.

Compared to the other subjects, teaching of the subject science involves the use of a wide range of equipment and tools since it should be taught with practical activities. The requirement instruments are then given in this guide.

At the end of each unit there are suggested evaluation and assessment procedures suitable for the said purpose. Here it is expected to examine whether the students have achieved the minimum learning competencies. Assessment process may happen during the lesson or at the end of the lesson.

At the end of each unit a check list is presented so that students them selves can check whether they have acquired the expected competencies. This would help students to evaluate themself and revise the parts of topics for which the competencies are not met.

Introduction

This teachers' guide is prepared based on the new textbook of general Science for grade 8. The new general science textbook in turn is based on the new instructional materials of general science for Grades 7 and 8. These materials are the flow chart, the minimum learning competencies and the syllabus. Which are prepared based on the general curriculum framework.

The core skills of the twenty first century such as learner-centered learning, diverse skills, use of indigenous knowledge and values, citizenship and cultural identity, learning to learn, critical thinking and problem solving, have been adequately addressed in all components of the General Curriculum framework.

At the beginning the learning outcomes of the unit, the key terms are given. Then a short introduction to the topics covered in the unit is given. Each topic/section of the textbook is then elaborated with explanatory notes, answers to questions raised and further background information. The competencies of each section are listed. Finally there is a way of stabilizing the skills and knowledge explored.

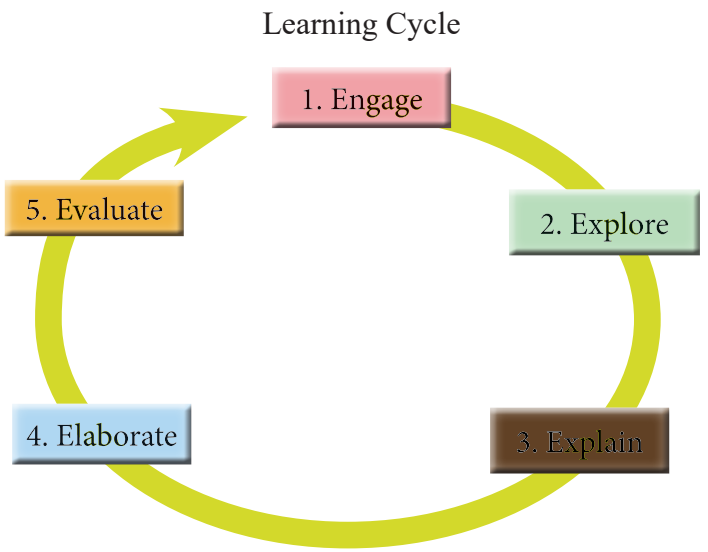
Main contents of grade 8 general science

Units Contents Periods allotted

No.	Unit	Periods allotted
1	Basics of Scientific Investigation	17
2	The Composition of Matter	11
3	Classification of Compounds	21
4	Human Body Systems and Health	30
5	Ecosystem and Conservation of Natural Resources	33
6	the Solar System	22
7	Physical Phenomena in the Surrounding	22

General suggestions to prepare lessons

The following learning cycle which is known as the 5E's instructional model is recommended for teachers to use it. Teachers use the 5E Model of Instruction to sequence lessons and activities which provide best first instruction for all stdents.



"The 5E Model of Instruction promotes active learning. Students are involved in more than listening and reading. They learn to ask questions, observe, model, analyze, explain, draw conclusions, argue from evidence, and talk about their own understanding. Students work collaboratively with peers to construct explanations, solve problems, and plan and carry out investigations." –Rodger Bybee

ENGAGE: In this phase a teacher engages students by having them mentally focus on a phenomenon, object, problem, situation, or event. The role of the teacher in the Engage phase is to present a situation, identify the instructional task, and set the rules and procedures for the activities.

EXPLORE: Once students have engaged in activities, they need time to explore ideas. Explore activities are designed so all students have common, concrete experiences. As a result of their mental and physical involvement in these activities, students question events, observe patterns, identify and test variables, and establish causal relationships.

EXPLAIN: The Explain phase consists of two parts. First, the teacher asks students to share their initial models and explanations from experiences in the Engage and Explore phases. Second, the teacher provides resources and information to support student learning and introduces scientific or technological concepts. Students use these resources and information, as well as ideas of other students, to construct or revise their evidence-based models and explanations.

ELABORATE: Once students have constructed explanations of a phenomenon or design solutions for a problem, it is important to involve them in further experiences that apply, extend, or elaborate the concepts, processes, or skills they are learning.

EVALUATE: It is important that students receive feedback on the quality of their explanations. Informally, this may happen throughout the learning sequence. Formally, the teacher can also administer a summative evaluation at the end of the learning sequence. The following assessment techniques can be used in continuous assessment; for grade 8 general science lessons.

i. Observation
ii. Presentation
iii. Participation in group work.
iv. Oral questions
v. Reports(written)
vi. Demonstration.
vii. Experiment

UNIT ONE

BASICS OF SCIENTIFIC INVESTIGATION

Time allotted to the unit: 17 periods

Learning Competencies for unit one:

By the end of this unit, learners will able to:

- identify the basic and derived units of measurements;
- explain the concept of measuring how physical quantities;
- describe the components of a scientific investigation;
- demonstrate ability to work effectively and respectfully with others in performing fair testing.

Contents of the Unit

1.1 Scientific Measurement (7 periods)

1.2 Doing Scientific Investigation (10 periods)

Unit Overview

This unit deals about scientific measurement and scientific investigation. So, students have to explore the importance of scientific measurement. Not only stating the importance of scientific measurement, but also measure available physical quantities using available measuring instruments. They should be able to compare the indigenous and scientific methods of measurement. Students should also be able to apply the recommended steps used to make scientific investigations.

1.1 Scientific Measurements (8 periods)

Learning Competencies

By the end of this section students should be able to:

- explain the concept of measuring Physical Quantities;
- describe the various indigenous methods of measurement;
- distinguish between the basic and derived physical quantities;
- categorize the basic and derived units of measurement;
- identify prefixes and perform conversions among units of measurement;
- distinguish between accuracy and precision in measurement.

Contents of the sub unit

1.1 Scientific Measurements

- Indigenous methods of measurement.
- Physical quantities and modern methods of measurement.
- Basic physical quantities and their units.
- Derived physical quantities and their units.
- Prefixes and conversion of units.
- Accuracy and precision in measurement.

Forward Planning Learning has to be effective in enhancing students' knowledge, skill and attitude. Thus, students have to use all possible ways to acquire these learning outcomes. The knowledge part should be developed through discussion, doing the activities and exercises. The skill part should be developed by doing hands on activities. The attitude part could be improved by appreciating the work of scientists.

The focus of this section is the measurement of physical quantity. It is basic because science is based on measurement. Both indigenous and modern methods of measurements have to be discussed in detail. The advantages and disadvantages of each have to be seen. Students' should finally be able to conclude why the scientific method is preferred than the indigenous methods of measurement.

The indigenous method have its own advantages and disadvantages. From the advantage side, its availability with minimum cost could be mentioned. Its weak side is the reliability. Because it varies from person to person its reliability is questioned.

The advantages of the modern method of measurement is, it is accepted world wide. Hence, if carefully used, no reliability problem. The problem here is it has a cost of buying the instruments.

Before going to measure something students have to define and understand what a physical quantity is. They should also be able to differentiate between fundamental and derived physical quantities and their corresponding units. How to measure the length, mass, time, and temperature using the appropriate devices should be discussed.

Students should be able to write large and small numbers using prefixes and practice them by converting one unit to the other.

Finally the difference between accuracy and precision in a measurement should be discussed.

Teaching Aids

The following teaching aids are suggested to be used.

- Indigenous and modern measuring instruments of length.
- Display the real measuring instruments if available.
- Show drawings of different measuring instruments.
- Show drawings of traditional measuring instruments.

Suggested teaching methods;

- Discussion
- Field trip
- Explanation (lecture) and
- Questioning and answering.
- Field-trip to the Institute of Ethiopian Standards

Subject matter presentation (Teaching Note)

Start the topic by asking students, what do they know about physical quantity, measuring physical quantity, units of physical quantity? Have they ever used prefixes? What about accuracy and precision?

These diagnostic questions will help you to know the prior knowledge of students. Then you can prepare your lessons accordingly.

Start the lesson by introducing the key terms that students are going to learn in the coming classes. Then, try to point out some traditional measuring units discussed in the textbook plus what you know from experience.

Activities 1.1 and exercise 1.1 are planned to explore the pros and cons of indigenous methods of measurement. From the observation of activity 1.1 students should be able to mention the weaknesses of the indigenous methods of measurement. This is important.

Students have to reach to a conclusion about the importance of the scientific methods of measurement. The main problem of indigenous measurement is reliability. All the discussions and measurements made should lead you to this conclusion. The conclusion is stating this reliability problem of the indigenous method for scientific measurements.

The traditional methods of measuring time, using the shadow of a tree (activity 1.2), is very interesting. It reminds the history of time measurement. Project 1.1 also reminds the history of measuring time.

In the indigenous methods of measurement it is advisable if students could visit markets where these measurements are in use. Project 1.2 is introduced for this purpose. Then let students present a report to their class. After hearing the report of each group you can then generalize by jotting down new findings.

In the modern methods of measurement some practical activities have to be made. At least using a ruler, students should be able to measure any quantity available in their class. They could measure the different sizes of their textbook, desk, blackboard or white board, class room and the like. Encourage students to make group discussions.

Activity 1.3: the importance of scientific measurement is very crucial. After each group have made their discussions, class level discussions are worthy. Then you make the summary of all the points raised about the importance of scientific measurement.

Students have to develop reading habits. For this purpose you can use project 1.1. They can prepare a report in group or individually.

In the measurement of mass, length, time, and temperature hands activities are mandatory. In addition to Activity 1.4, Using any of the devices mentioned in the textbook, practical measurements have to be made.

Content Background Information

It is because of unreliability of traditional units, scientists developed standard and reliable units. This gave rise for the **System of International units (SI units).** Let students focus on the basic concepts such as:

i) Measurements: It simply is the comparison of something with a given standard units.

ii) Standard units: They are conventional units which are used to measure physical quantities scientifically.

Physical quantities are grouped into two:

1. Fundamental (basic) physical quantities, and

2. Derived physical quantities,

Basic (fundamental) physical quantities are limited in numbers (They are only 7). They can be described only by themselves, while derived physical quantities are computed by combining two or more fundamental physical quantities. They can be described in terms of basic physical quantities. The units of fundamental quantities are called fundamental units. These are standard units defined by scientists agreement from all over the world.

On the other hand the units of derived quantities are called derived units. They are derived by combining the fundamental units.

The result of a measurement could be very small or very large. Hence, prefix, a method of writing very small and very large quantities need to be discussed. Examples 1.2 and 1.3 and exercise 1.3 will help you to accomplish this.

Accuracy refers to how a measurement is closed to the accepted value while precision refers to how measurements are close to each other.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Suggested answer for activities and projects.

Activity 1.1: The size of students span, cubit and digit are not equal. This has to be seen from the measurements taken by the students themselves. This fact can be used to discuss the importance of the scientific methods of measurement.

Activity 1.2: At different times of a day the height of a shadow is different. This can be used to have a traditional shadow clock in your school compound. Invite the school community to use this clock. Finally conclude by discussing the reliability problem of this clock. At different seasons of a year, the duration of day and night is different, which affects the height of the shadow of a tree.

Activity1.3: Scientific measurement has the following importance.

- By taking these measurements we can better understand the world around us.
- Measurement is necessary for sharing information between scientists around the world.
- Measurements are useful to do basic tasks in our daily life such as buying and selling. Knowing the temperature of the day, measure the time taken for an event etc.
- Measurements can also allow us to make decisions based on the outcome of the measurement.

Project 1.1:

Sundial

In 1500 B.C simple sundials were used to divide the time interval between sunrise and sunset in 12 different parts. The Ancient Egyptian were known to use it. The shadows that move to different marks enabled the Egyptians to calculate time which helped to divide day into two parts. It also solicited summer and winter.



Sundial

Sand-clock

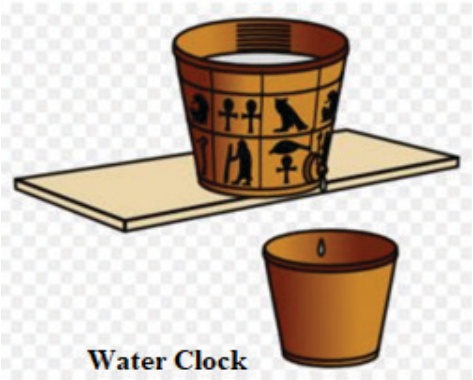
The sand-glass/ hourglass, made up of two conical glass connected vertically by the narrow neck, came into being in the 14th Century. It could measure passage of specific time period depending upon the size and width of the glass and the quantity of sand in it.



Sand Clock

Water clock

Water clock was known to have existed in Babylon in Egypt around 16th Century. It was used to measure time observing steady flow of water from or into a container. Measurements were marked on the container but there were variations due to the pressure of water flow.



Water Clock

Project 1.2: Seeing is better that hearing. So, arrange your students to visit a nearby market and investigate different indigenous measuring method used. Let each group representative present a report. In addition to the knowledge they got, this will improve students' communication skill.

Answer key to Exercises

Exercise 1.1: This exercise has two way uses. One students practice measurement, two students could see the problem with the indigenous methods of measurement, simply comparing their measurement with their friends measurement.

Exercise 1.2: One quntal is not strictly equal to 100 kg, it could be less than 100 kg or greater than 100 kg. This shows that this traditional measurement have a reliability problem.

Exercise 1.3: The problems with the indigenous methods of measurement are already discussed. The advantages of the indigenous measurement methods are: it is cost free and available at any time.

Exercise 1.4:

(a) Volume = length x breadth x height = m x m x m = m^3

(b) $density = \frac{mass}{volume} = \frac{kg}{m^3}$

(c) Force = mass x acceleration = $kg\ x\ \frac{m}{s^2}$

Exercise 1.5

1. **a)** 0.6 km = 0.6 x 1000 m = 600m = 600x100cm = 60, 000 cm

b) $500g = 500 \times \frac{1}{1000} kg = 0.5\,kg$

c) $30\,\text{min} = 30 \times \frac{1}{60} hr = 0.5\,hr$

d) 50 m = 50 x 1000 mm =50,000 mm

e) 0.25 kg = 0.25 x 1000 g = 250 g

f) 0.5 hour = 0.5 x 60 min = 0.5 x 60 x 60 second = 1800 second

2. a) 3500 m = 3.5 x 1000m = 3.5 km

b) 0.0012 sec = 1.2 x 0.001sec = 1.2 ms

c) 0.01 g = 0.01 x 1 g = 1 cg

Exercise 1.6: Convert the following measurements:

(a) 2.5 kg = 2.5 x 1000 g = 2 500 g

(b) 200 g = 200 x 1000 milligram = 200,000 mg

Exercise 1.7: Convert the following into the required measures:

(a) 8 m = 8 x 1000 mm = 8, 000 mm

(b) $5500\,m = 5500 \times \frac{1}{1000}\,km = 5.5\,km$

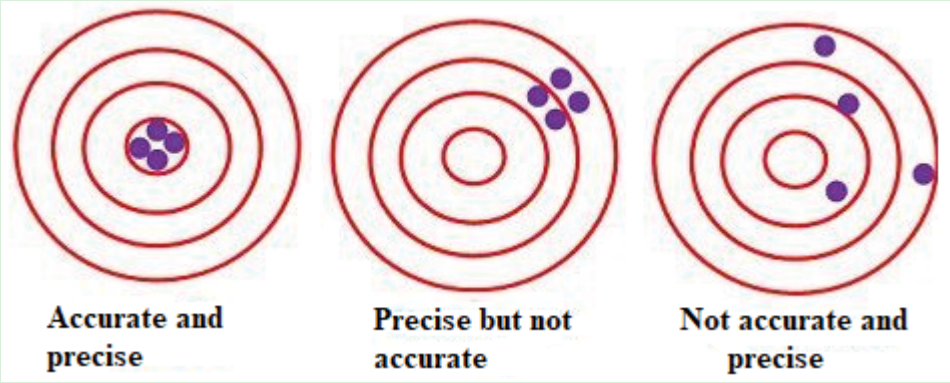
Exercise 1.8:

(a) 1 day = 24 hours = 24 x 60 minutes = 1440 minutes

(b) 1 day = 24 hours = 24 x 60 minutes = 1440 x 60 seconds = 86,400 seconds

Exercise 1.9:

When the player shoots with accuracy, his/her aim will always take the dart close to or into the target. If the player shoots with precision, his/her aim will always take the dirt to the same location which may or may not be close to the target. A good player will be both accurate and precise by shooting the dart the same way each time and each time striking the target.



Exercise 1.10:

1. A physical quantity is a property of an object, something we can measure with instruments or even by using our senses.

   - The Fundamental Quantity refers to a physical quantity that cannot be stated in any other physical quantity. Fundamental unit is the unit of fundamental quantities.
   - Derived quantity is a quantity that that is defined in terms of fundamental quantities. Derived unit is the unit of derived quantities.

2. The commonly used indigenous methods of measurement used in Addis Ababa local markets are: cubit, span, foot, pace, bichuko, jog, sini, kubaya etc.
3. Prefix is a symbol used to represent small or large values.
4. Accuracy refers how close a measurement is to the true value while precision refers to how close measurements are to each other.

1.2 Doing Scientific Investigation

Number of periods allotted: 10 Periods

After completing this section, students will be able to:

- describe the components of a scientific investigation;
- demonstrate ability to work effectively and respectfully with others in performing fair testing;
- practice scientific investigation procedures using appropriate contents to their age levels.

Forward Planning

Read about scientific investigation from the student's text book, reference books and other resources. Design a plan to cover the content of the section within a given period. In your plan, show the time allotted for group discussion on the activities, project work, presentation, for harmonizing concepts and other activities. Prepare yourself on the activities, project work and exercise.

Teaching Aids

- Diagram that shows the steps of scientific method
- Locally available materials those are used to doing scientific investigation

Subject Matter Presentation

It is advisable to use question and answer, group discussion, role play model and presentation as methods of teaching.

You may start this lesson on dealing with introduction of scientific method and give for students **Activity 1.6** The activity is designed to helps students to realize the applications of scientific investigation. Let them discuss this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentations, you may summarize concepts as follows.

The scientific method can be used to help an individual or groups logically or reasonably come to a conclusion concerning a specific subject or topic. The scientific method is used by many people such as scientists, historians, investigators, doctors, engineers, students, as well as anyone else who wants to rationally solve a problem. The scientific method will not be able to answer every single question or solve every problem that someone might have, but it has been proven to be very useful in countless situations.

Then, continue on dealing with steps of scientific method. Describe each step of scientific method and give illustrative example. Then let them form groups and do **Activity 1.7**. This activity helps students to motivate to say "**I will be a scientist or investigator …**" for the future. Facilitate group discussions by clarifying methods or questions raised during their discussion. After the discussion, encourage them to present their findings to the class. Harmonize their discussions by providing possible answers for activity1.7.

Activity a

1. **Ask Question:** What is the effect of sunlight on the growth of bean plant?
2. **Do back ground Research**: Water, fertilize soil and sunlight are necessary for the growth of plants.
3. **Formulate Hypothesis:** The null hypothesis is that there will be no difference between growing a bean plant in the absence of sunlight (indoor) or presence of sunlight (outdoor). The alternative hypothesis is that there will be a colour and a statistically significant difference between the two growing situations for bean plants.

4. **Test Hypothesis by Experiment and Collect Data:**

Planting two bean plants in separated pots using the same type of soil. Place one of these in an outdoor location, and place the other one in an indoor location. Care for the plants in an identical way, like giving the same amount of water. Then, each day for the three-week experimental period, observe and measure plant growth. Carefully record your observation and the size of each plant in a notebook.

5. **Analyze the Results and Draw Conclusion:**

Review the data and determine how the plants in both environments progressed over the course of the three weeks. Based on the data you collected, draw the conclusion including the following.

- The colour of bean plant indoor location is yellow.
- The colour of bean plant outdoor location is green.
- Sunlight is necessary for the growth of plants.

6. **Communicate Results**: Report their findings in the form of a written report as an oral presentation. Sunlight is necessary for the growth of plants.

Activity b

1. **Ask Question:** Does a coiled nail act like a magnet?
2. **Do Background Research**

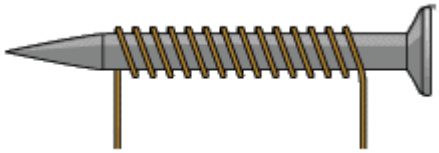
If a coiled nail acts like a magnet, a compass placed near it should be deflected and the piece of metal like iron fillings should be attracted to it.

3. **Establish your Hypothesis**. Yes a coiled nail act like a magnet.
4. **Test your hypothesis.**

Bring a compass near the coiled nail or sprinkle iron filings on it. If the compass is deflected and the iron filings are attracted to the coiled nail then it act like a magnet. If not the hypothesis is wrong. You need to change your hypothesis.

5. Analyze the Result

A compass needle placed near a coiled nail doesn't show a deflection and iron filings sprinkle on it are not attracted.



Since the hypothesis is incorrect try another hypothesis

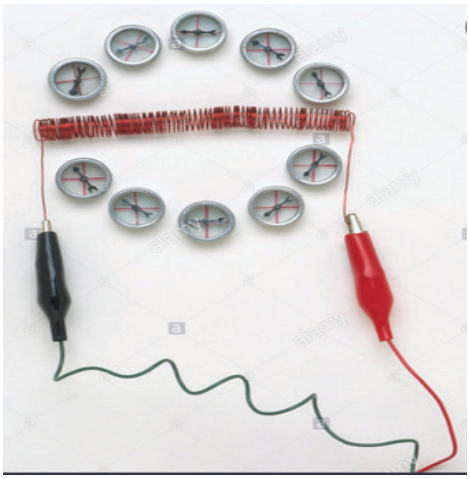
Hypothesis-2: Acurrent carrying coiled nail act like a magnet.

4. Test your Hypothesis.

Bring a compass near a current carrying coiled nail or sprinkle iron filings on it.

5. Analyze the result

A compass needle placed near a current carrying coiled nail show a deflection and iron filings sprinkle on it are attracted by the nail. See the figure.





6. Communicate the result

Since the hypothesis is correct we can communicate the resuls as follows.

Result: A current carrying coiled nail act like a magnet.

Activity c

1. **Ask Question**: How do plants store their food in their leaf?
2. **Do Background Research**

Within plants, sugar made during photosynthesis converts to starch which is stored in various parts of the plant. The cells use it for energy to drive all life processes. Iodine is an indicator to find starch and it turns dark blue/purple when starch is present. This change of color shows the presence of starch that is stored in that part of the plant.

3. **Formulate Hypothesis**

The null hypothesis is that there will be no food stored in plant leaf. The alternative hypothesis is that there will be food stored in plant leaf.

4. **Test Hypothesis by Experiment and Collect Data:**

Procedures

1. Remove a green leaf from a plant that has been exposed to sunlight for a few hours.

2. Half-fill a 250cm^3 beaker with water. Heat the water until it boils. Keep the water at boiling point.

3. Use the forceps to place the leaf in the boiling water. Boil for 2 minutes.

4. Turn off the Bunsen Burner. (If you are using a heat source without a naked flame - electric water bath or hot plate - this step is unnecessary.)

5. Place the boiled leaf in a boiling tube containing 90% ethanol.

6. Place the boiling tube in hot water and boil for 10 minutes or until the leaf decolourizes. (It may be necessary to replace the ethanol).

7. Gently remove the leaf and wash with a fine trickle of cold tap water.

8. Spread the leaf evenly on a white tile.

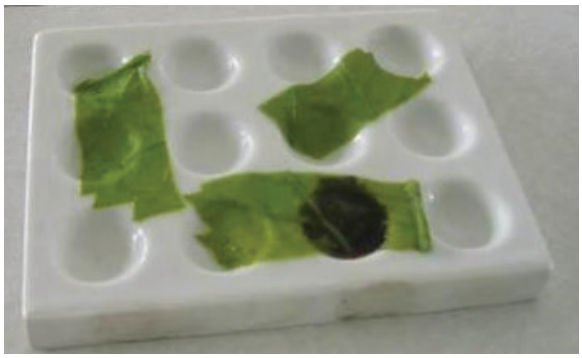
9. Add a few drops of iodine/potassium iodide solution to the leaf and note any observations.

5. Analyze the Results and Draw Conclusion:

The leaf was flaccid (soft) after being boiled in water. The ethanol changed from colorless to green. The leaf was brittle after being boiled in ethanol. The leaf becomes flaccid once more after being rinsed in cold water. After iodine solution was added:

i. No colour change (Iodine Solution remains brown), this indicates that starch is not present in the plant leaf.

ii. Iodine /potassium iodide solution changed from brown to blue black this indicates that starch is present in the plant leaf. Therefore, plants store their foods in their leaf.



6. Communicate Results: Report your findings in the form of a written report as an oral presentation. Plants store their foods in their leaf.

D. Plants get many of the elements they need through the air. Oxygen, carbon and hydrogen are readily available. In addition, plants can create glucose and other substances through sunlight. However, basic elements cannot be created through photosynthesis and plants must extract these elements through the soil. Even though air contains a significant amount of nitrogen, plants cannot be absorbing it. As a result, they must get it from the soil.

Nitrogen becomes depleted in soil quickly, and the primary benefit of fertilizer is the nitrogen it provides. Plant cells also depend on potassium and phosphorus which are rare. Fertilizer contains a large amount of these elements, which ensures that plants stay healthy. Plants can generally grow without fertilizer, but they may take more time to get the elements they need to thrive. Fertilizer is essential in modern farming, and almost all farmers depend on it to keep their fields healthy and productive. Guardant often use small amounts of fertilizer as well to ensure that their flowers and other plants look their best.

E. Bread and mold often meet through the mold spores that are in the air. Although you cannot see them, there are probably millions in the air around you. These spores can accumulate in the dust around our home, which is kicked up through cleaning or even someone walking by. The spores can then settle on your bread and the bread molding process will begin. Mold will not only live and feed on bread, it will also reproduce there. This is why you see bread mold spread throughout your loaf if you let it sit there long enough. Mold reproduces as long as it has a nutrient source - sometimes it can double in size in an hour's time.

F. Waste management in schools

Separating, reducing, reusing, recycling and composting are good options for managing school waste. Boards need to find ways to get rid of school waste with the least negative effects on the environment. Incinerating and building waste pits on the school grounds can only be done by schools with no other options.

Separate waste

Separating waste is the first step in managing your school's rubbish. Set up bins for the different kinds of waste, and make sure the right bins are used. You should have clearly labelled bins for glass, paper, plastic, cans and for organic waste.

Reduce waste

Avoid sending waste to a landfill. Landfills cause environmental problems, such as unpleasant smells and contaminants and toxins leeching into water and the air. Educate staff and students about using other ways of disposing of waste, such as recycling, reusing and composting.

Reuse waste

Think about reusing waste around the school and the school community, including:

- taking lost property to your local opportunity shop
- using plastic bags as bin liners or as packaging, instead of bubble wrap
- having students make recycled paper and use shredded paper as bedding for pets.

Recycle waste

Contact your local council to find out what can be recycled in your area. Generally, you can recycle:

- glass
- paper and cardboard
- plastic etc.

Make sure recycle bins are used correctly and that the items are clean when they go in the bin. For recycling to work, educating students and staff is essential. Some local council help schools to set up recycling programs and educate their staff and students.

Compost organic waste

Separate organic waste like food scraps, plants, paper and lawn clippings from other rubbish.

Use organic waste for composting and teach students about how it works. You can use the compost on the school gardens, saving on the cost of fertilizer and other chemicals.

Burning waste

Very few schools still use incinerators. They're usually only used at remote schools without easy access to other waste disposal facilities. Incinerators put contaminants into the air and can be a health hazard.

Assessment

Assess each student's work throughout section 1.2.You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing the activity 1.6-1.7
- presenting their views after discussion,
- answering questions during mini-lecture.
- answering exercise 1.13
- project work
- answering questions given as quiz or test.

Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Answers to Exercise 1.11

1. Ask Questions
2. Do back ground Research
3. Formulate Hypothesis
4. Test Hypothesis by Experiment and Collect Data:
5. Analyze the Results and Draw Conclusion:
6. Communicate Results

Answers to Review Exercise Of Unit One.

1. (c) temperature
2. (c) derived units are derived from base units
3. (b) area is a derived quantity
4. The SI unit of density is (b) kg/m^3
5. The prefix that represents $\frac{1}{1000}$ is (d) milli

II. Fill in the blank spaces with an appropriate word.

6. fundamental
7. derived
8. One thousand
9. centi
10. Kg/m^3

III.

11. (c) m^2
12. (a) K
13. (e) kg/m^3
14. (b) m^3
15. (d) kg

IV. Give short answer

16. Mass - kilogram (kg), length - meter (m), time - second (s) and temperature – kelvin (K).
17. Speed = m/s, area = m^2, volume = m^3 and density = kg/m^3.
18. 0.005 m = 5 x 0.001 m = 5 mm.
19. $1000\,cm = 1000 \times 0.01m = 10m = 10 \times \frac{1000}{\cancel{1000}}m = \frac{10}{\cancel{1000}}km = 0.01km$.
20. This measurement is not accurate because its average value (12.17 m/s^2) is far from the accepted value (9.81m/s^2). But it is precise because the results are close to each other.

UNIT TWO
THE COMPOSITION OF MATTER

Number of periods allotted: 11 periods

Unit Overview

This unit deals with the composition of matter. It is an abstract concept because it requires convincing students about the presence of extremely small particles which millions of them collected together cannot even is seen by our naked eye.

The first section discusses early thinking about the composition of matter by comparing and contrasting the discreteness and continuity theory of matter.

In the second section inside of an atom is presented. It explains first about parts of an atom (nucleus and electron Shells). Next the Subatomic particles of the atom, relative mass, the charge and location of sub-atomic particles, atomic number and mass number and determination of the electrons, protons and neutrons are described here.

The last section describes the molecules. It gives emphasis to differentiate molecules of elements from molecules of compounds.

Unit Outcomes:
At the end of this unit, learners will able to:

- narrate the historical development of the atomic nature of substances;
- appreciate that atoms are the building blocks which make up all substances;
- demonstrate understanding of the idea that the identity of a substance is determined by its atomic structure;

- differentiate molecules of elements from molecules of compounds;
- demonstrate scientific inquiry skills along this unit: communicating, asking questions, drawing conclusions, applying concepts.

Main contents

2.1 Early thinking about the composition of matter

2.2 Inside of an atom

- ✓ Parts of an atom (nucleus and electron Shells)
- ✓ The Subatomic Particles of the atom
- ✓ Relative mass, the charge and location of sub-atomic particles
- ✓ Atomic number and mass number
- ✓ Determination of the electrons, protons and neutrons

2.3 Molecules

- ✓ Molecules of elements
- ✓ Molecules of Compounds

2.1 Early Thinking about the Composition of Matter

Number of periods allotted: 3 Periods

After completing this section, students will be able to:

- give a short history of the concept of the atom;
- compare and contrast the continuity and discreteness (discontinuity) theory of matter;
- compare earlier conceptions of the structure of matter with their conceptions.

Forward Planning

Read about early thinking about the composition of matter from the student's text book and other reference books. Design a plan to cover the content of the section within a given period. In your plan, show the time allotted for group discussion on the activities, presentation, for harmonizing concepts and other activities. Prepare yourself on the activities and exercise.

Teaching Aids

- Table chart that shows comparison between the discreteness and continuity theory of matter.
- Periodic table

Subject Matter Presentation

It is advisable to use question and answer, group discussion, and presentation as methods of teaching.

You may start this lesson with the **Activity 2.1**. The activity is designed to brainstorm students on matter and matters made up of. Let them discuss this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentations, summarize concepts as follows.

1. Matter is anything that has mass and takes up space.
2. Matter is made up of tiny particles with spaces in between them.

Then, continue on dealing with thoughts of ancient Greek philosophers (Aristotle and Democritus) on composition or nature of matter. Describe their thoughts and give for students' **Activity 2.2**. This activity is designed for students to forward their ideas on the two thoughts (continuous and discrete nature of matter). Let them discuss in groups for a few minutes. Invite two students from two groups to debate their ideas. After their debate harmonize as follows:

Aristotle and Democritus replied the question in two opposing ideas.

a. **Aristotle's believe**

Matter can be divided and subdivided infinitely. According to Aristotle, matter is continuous. For example, take some aluminum foil. Cut it in half. Cut one of the pieces in half again. Cut one of those smaller pieces in half again. Continue cutting, making smaller and smaller pieces of aluminum foil. These smallest pieces are still aluminum foil; they are just becoming smaller and smaller.

b. **Democritus's believe**

Matter can be divided and subdivided up to a certain point. Beyond this point, we would obtain the smallest indivisible particles called atoms. According to Democritus, matter is discrete. For example, take some aluminum foil. Cut it in half. Cut one of the pieces in half again. Cut one of those smaller pieces in half again. Continue cutting, making smaller and smaller pieces of aluminum foil. These smaller particles are ''atoms'' from which the aluminum foil is built up.

Tell students the invisibility of particles to the naked eye and that is way we perceive materials as continuous. Explain that even scientists themselves did not understand about particles until quite recently. They had been work for 2000 years before the idea of atoms was accepted in the early 19^{th} century.

Like students who debate on the two different ideas mentioned in activity 2.2, for many centuries there were two different theories about the nature of matter. Some people believed that matter is continuous, that is, the same all through without any spaces. Others held that matter is discrete or particulate- that is, made up of tiny particles with spaces in between them.

Finally give **Exercise 2.1** as homework.

Assessment

Assess each student's work throughout section 2.1. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each

student in:

- discussing the activity 2.1 and 2.2.
- presenting their views after discussion,
- Answering questions during mini-lecture.
- Answering exercise 2.1.
- Answering questions given as quiz or test.

Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Answers to Exercise 2.1

1.

Discreteness Theory	Continuous Theory
➢ Proposed by Democritus	Proposed by Aristotle
➢ There is a limit to which matter is broken	Matter is infinitely divisible
➢ Believed in the existence of atoms	Rejected the idea of atoms

2. If someone proceeded on breaking down a substance, it would be impossible to reach to the last indivisible particles. This indicates that a substance is continuous.

2.2 Inside of an Atom

Number of periods allotted: 5 Periods

After completing this section, students will be able to:

- Describe the structure of an atom as a nucleus containing protons and neutrons, surrounded by electrons in shells (energy levels);
- State the relative charge and approximate relative mass of a proton, a neutron and an electron;
- Draw hydrogen atoms, including the location of the protons and electrons, with respect to the nucleus;
- Differentiate between mass number and atomic number;
- Determine the number of protons, neutrons, and electrons in an atom.

Forward Planning

Take enough time to prepare for this section. Read the contents on inside of an atom from the student's text book and other reference books to well understand the subject matter. Make a plan of your own on how to manage students during group discussion, presentation and assessment. In your plan show the time allotted for each activity and exercise. Prepare charts that show the diagrammatic representation of atoms. Prepare also a table chart that shows the nature and location of subatomic particles.

You are advised to read this guide before the lessons to get more information about the activities and the methodologies you follow.

Teaching Aids

- Chart that shows the diagrammatic representation of the atom (Figure 2.1)
- A table chart that shows nature and location of subatomic particles (Table 2.2).
- Periodic table.

Subject Matter Presentation

You are advised to use group discussion, question and answer and gapped lecture as teaching methodology.

Parts of an Atom

You can start this topic by asking students to tell the two parts of an atom. After their attempts, describe the two regions (atomic nucleus and atomic shell) of an atom diagrammatically.

Subatomic Particles

You can start this topic by asking students to tell the three fundamental subatomic particles. Then let the students discuss **Activity 2.3** in groups. This activity is designed to help students practice drawing model of atoms and realize the location of subatomic particles. After they draw the model of hydrogen on their exercise book, invite some of the groups to draw the mode on the board using

colour calk based on the instruction described in text book. Then harmonize concepts as follows:



After activity 2.3, describe the subatomic particles and then discuss the location, charge and relative mass of subatomic particles.

You can summarize this topic by using **Table 2.2** from the student's text book.

After that, let them do **project work** in groups. This project work is designed to help students develop their skills and creativity in preparation of hydrogen model from locally available materials. Here it is advisable for you to allow students to do project work on their own in groups. Give enough days for students. Assist them whenever they are in need. When they complete the project work, tell group representatives to show and describe their project work to the rest of the class.

Atomic Number and Mass Number

You can start this lesson with the **Activity 2.4**. The activity is designed to brainstorm students on atomic number and mass number. Let them discuss this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentation, harmonize concepts using periodic table. (Refer **activity 2.5)**.

Then, continue by defining 'atomic number' and 'mass number' and showing their symbolic notation. Then illustrate how they are written or described with the symbols of elements as shown below.



Determination of the electrons, protons and neutrons

Here you are also advised to give **Activity 2.5**. Let them do this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentation, harmonize **activity 2.4** and **activity 2.5** using periodic table as follows:

Atoms	Atomic number	Mass number	Proton number	Neutron number	Electron number
H	1	1	1	0	1
He	2	4	2	2	2
Li	3	7	3	4	3
Be	4	9	4	5	4
B	5	11	5	6	5
C	6	12	6	6	6
N	7	14	7	7	7
O	8	16	8	8	8
F	9	19	9	10	9
Ne	10	20	10	10	10

Next show how number of protons, electrons and neutrons are determined (calculated) from atomic number and mass number using examples.

Finally give **Exercise 2.2** as a home work.

Assessment

Assess each student's work throughout section 2.2. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing the activity 2.3 and 2.4,
- presenting their views after discussion,
- Answering questions during mini-lecture,
- Answering exercise 2.2,
- Project work,
- Answering questions given as quiz or test.

Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Additional Questions

1. What are the atomic numbers and mass numbers of elements whose atoms are made up of
   a. 13 protons, 14 neutrons and 14 electrons.
   b. 16 protons, 16 neutrons and 16 electrons.
2. How many protons, neutrons and electrons are there in atoms of the following elements?
   a. Calcium (Z =20, A = 40)
   b. Sodium (Z = 11, A =23)

Answers to Additional Questions

1. a. Atomic number = 13, mass number = 27

   b.. Atomic number = 16, mass number =32

2. a. 20 protons, 20 neutrons and 20 electrons

   b.. 11 protons, 12 neutrons and 11 electrons

Answers to Exercise 2.2

1.

Particle' Name	Location	Actual Mass (g)	Relative Mass (amu)	Relative Charge
Proton	Nucleus	1.673×10^{-24}	1	+1
Electron	Outside nucleus	9.109×10^{-28}	0	-1
Neutron	Nucleus	1.675×10^{-24}	1	0

2. i. fluorine ii. 19
3. neutron = 7, proton = 7, and electron = 7

2.3 Molecules

Number of periods allotted: 3 Periods

After completing this section, students will be able to:

- define molecules;
- give examples of monatomic, diatomic and polyatomic molecules;
- use models or particles model diagram to represent molecules of elements and compounds.

Forwarding Planning

Prior reading about molecules from the student's text book and other reference books is very useful for the teacher. This section contains one exercise only. Do it before the lesson and check the answers from this guide. Prepare charts that show diagrammatically monoatomic, diatomic and polyatomic molecules. Make a plan of your own how to manage this section. In your plan show the time allotted for your presentation and exercise given to students.

Teaching Aids

- Charts that show diagrammatically monoatomic, diatomic and polyatomic molecules.

Subject Matter Presentation

To teach this section, it is advisable to use brainstorming, question and answer, and presentation as methods of teaching.

Molecules of Elements

You can start this lesson with the **Activity 2.6**. The activity is designed to brainstorm students on molecules and examples of molecules. Let them discuss

this activity in groups for a few minutes and invite some students from different groups present the group ideas to the class. After their presentation, harmonize concepts as follows:

1. A molecule is the smallest particle of an element or a compound that can exist freely in nature.
2. Monoatomic molecules: He, Ne, Ar, etc.
   Diatomic molecules: H_2, Cl_2, F_2, etc.

Then, explain about molecules of elements by giving examples of monoatomic, diatomic and polyatomic molecules those are not mentioned by students. Here it is advisable to use the diagrams of monoatomic, diatomic and polyatomic molecules that you brought to the class.

Molecules of Compounds

Continue teaching by asking students what molecules of compounds are and giving examples. After their attempts, tell them the appropriate definition and examples by referring student's text book.

Finally give them **Exercise 2.3** as homework.

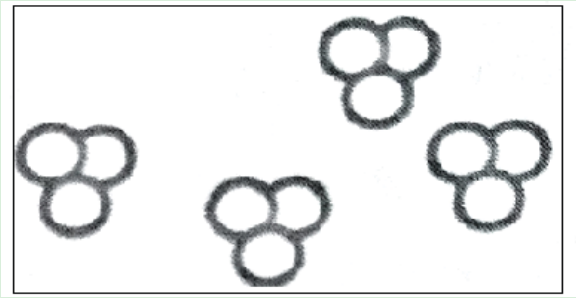
Assessment

Assess each student's work by observing how a student is involved in discussing the **Activity 2.6**, in her or his groups, answering questions raised during presentation. Your assessment should be based also on their trial to do questions given in exercise 2.3.

Appreciate students working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum requirement.

Answers to Exercise 2.3

1. A molecule is the smallest particle of an element or a compound that can exist freely in nature.
2.
   a. Monoatomic molecule
   b. Diatomic molecule
   c. Polyatomic molecule
   d. Polyatomic molecule
   e. Monoatomic molecule
   f. Diatomic molecule



3.
   a. Molecule of element
   b. Molecule of compound
   c. Molecule of compound
   d. Molecule of element
   e. Molecule of compound
   f. Molecule of element

Answers to the Review Exercises on Unit Two

I. True/ False

1. True
2. True
3. False
4. False
5. False

Multiple choices

6. B
7. D
8. B
9. C
10. A
11. C
12. A
13. C
14. C

II. Give short answers

15. Atomic nucleus and atomic shell (electron)
16. Proton, neutron and electron
17. Atomic number = 8, number of protons = 8, number of neutrons =8, number of electrons = 8 and mass number = 16.

UNIT THREE

CLASSIFICATION OF COMPOUNS

Number of periods allotted: 21 periods

Unit Overview

This unit deals with the classification of compounds. It is divided in to four subunits. The first sub-unit tries to introduce the classification of compounds as organic and inorganic.

The second subunit discusses organic compounds. The simplest type of organic compounds that contain carbon and hydrogen only are hydrocarbons. It only gives much emphasis to the following three major types of hydrocarbons: alkanes, alkenes and alkynes. Even through the chemistry of these hydrocarbons is very vast, it focuses on the formulas and names of the first ten alkanes, alkenes and alkynes. Some of the uses of hydrocarbons such as methane, propane and butane and ethyne are discussed. In addition, the importance of some oxygen containing derivatives of hydrocarbons such as ethanol, ethanoic acid and formalin are also explained.

The third subunit describes inorganic compounds. First, it presents classification of inorganic compounds. Next, it presents the definitions and properties of oxides, acids and bases. In this section, some experiments are also designed to be conducted to show the properties of acids and bases, and preparation of sulphur dioxide and magnesium oxide.

The fourth subunit describes neutralization reaction and salts. First, it presents some uses of neutralization in daily life. Next it presents the definitions, naming and writing formulas and uses of some common salts.

Unit Outcomes:

At the end of this unit, learners will able to:

- explain the classification of compounds into organic and inorganic;
- write the formulas and names the first ten alkanes, alkenes alkynes and list the uses some important common organic compounds;
- classify oxides into different groups and give examples of each group;
- develop skills in identifying acidic, basic and neutral solutions;
- define, and apply the concept of neutralization;
- explain the safety precautions while working with acids and bases;
- demonstrate scientific inquiry skills along this unit: Observing, classifying, comparing and contrasting, communicating, asking questions, designing experiment, drawing conclusion, applying concepts and problem solving.

Main contents

1.1 Introduction
1.2 Organic compounds
1.3 Inorganic compounds
1.4 Neutralization reaction and salts

3.1 Introduction

Number of periods allotted: 2 Periods

After completing this section, students will be able to:

- define organic compounds as carbon containing compounds and give examples;
- define inorganic compounds as compounds of elements other than carbon.

Forward Planning

Dear teacher, since students will learn using active learning methods, it is advisable to plan group formations. In addition, prior reading about classification of compounds from the student textbook or other reference books is worthwhile.

Teaching Aids

- Charts that show the classification of chemical compounds and the different classes of organic compounds.
- Sodium chloride (common salt) and sugar (sucrose)

Subject Matter Presentation

For this subunit, brainstorming, group discussion, gapped lecture and presentation can be used as active learning methods.

You can start this topic by grouping students and letting them discuss the **Activity 3.1** for a few minutes. The activity 3.1 helps them to brainstorm about the classification of substances which they learned in grade 7 general science. The activity also helps students to realize the earlier and modern concepts of organic and inorganic compounds. You can facilitate their discussion by clarifying misconceptions (if any). Some students may not be active in group discussions due to various reasons. It would, therefore, be better to identify these students and encourage them to participate in their respective groups. After their discussion, allow them to present their ideas to other group members. Then, harmonize their discussion by providing the following answers.

1. Organic compounds are compounds derived from living things. Early chemists believed that organic compounds differed from inorganic compounds because living things had a special 'life force' within them, which was invisible and hard to detect. According to the theory of 'life force', the only source of organic compounds was nature itself (*plants* and *animals*). Inorganic compounds are compounds derived from non-living things.

2. No. Inform them that the "life force" theory was disproved by Friedrich Wohler after he synthesized urea in 1828 for the first time.
3. Organic compound currently refers to the compounds contained in and derived from plants and animals as well as those synthesized by man artificially. Inorganic compounds are the compounds consisting of mineral constituents of the earth or generally found in non-living things.

You can use gapped lecture to discuss historical classifications of compounds as organic and inorganic. To illustrate organic and inorganic compounds, you can use familiar examples like common salt for inorganic compounds and sugar for organic compounds.

Assessment

You assess each student's work continuously throughout the subunits. This can be done by preparing a performance sheet and recording the performance of every student. You can make records based on the students' performance in discussing the activity 3.1, presenting their views after discussion and answering the questions in exercise 3.1.

By observing their performances from the record, provide them with feedback to improve students' learning (formative assessment). Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit.

Additional Questions

1. Classify each of the following compounds as organic or inorganic.

    a. Glucose
    b. Sodium hydrogen carbonate
    c. Acetic acid
    d. Carbon dioxide
    e. Marble

f. Magnesium sulphate
g. Citric acid
h. Copper oxide

Answers to Additional Questions

a. Organic
b. Inorganic
c. Organic
d. Inorganic
e. Inorganic
f. Inorganic
g. Organic
h. inorganic

Answers to Exercise 3.1

a. Organic
b. Inorganic
c. Inorganic
d. Organic
e. Organic
f. Organic

3.2 Organic Compounds

Number of periods allotted: 7 periods

After completing this section, students will be able to:

- define hydrocarbons and mention at least one source of hydrocarbons;
- write the general formula of alkanes, alkenes and alkynes;
- write the specific chemical formulas of the first ten members of alkanes, alkenes and alkynes;

- describe a homologous series and its general characteristics;
- name the first ten members of alkanes, alkenes and alkynes;
- identify some common uses of organic compounds.

Forward Planning

Prior reading about the formula and naming of hydrocarbons as well as the uses of organic compounds is very useful. This subunit also contains a significant number of activities. Hence, it is advisable to refer to the answers of these activities from this teacher's guide; you also need to make a plan that shows the topic and activity you are going to deal with during each period. Your plan should be prepared in a manner that enables you complete the contents in this section within a given periods. Moreover, you need to prepare a chart that shows the classifications of hydrocarbons. You may also need a lighter to explain the importance of gaseous hydrocarbons.

Teaching Aids

- Lighter and a chart that shows the classification of hydrocarbons.

Subject Matter Presentation

Hydrocarbons

For this subtopic, gapped lecture, group discussion, presentation, and independent work can be used as active learning methods.

You can start teaching this topic with **Activity 3.2.** This activity lets them to draw their attention to the topic under discussion and realize the sources of hydrocarbons. Thus, let them do the activity in groups for some minutes. Facilitate group discussions by clarifying ideas that are not clear to them. When they complete, give chance to some group representatives to present the answers to the class. Next, harmonize ideas by telling to them the following information.

1. Hydrocarbons are compounds of carbon and hydrogen. Therefore, they are classified as organic compounds.
2. The sources of hydrocarbons are natural gas, petroleum and coal.They are found in Ethiopian Somali region particularly in Ogaden.

The chart you prepared can be used to illustrate the classification of hydrocarbons.

Inform to students the general formula of alkanes. Use gapped lecture to introduce to students what homologous series, homologues and alkanes are. Give them **Exercise 3.2** as class work and check their work. After that, help the students to know about alkenes and give them **Exercise 3.3** as class work. Finally, let the students distinguish alkynes from alkenes and alkanes. After they do so, you may give them **Exercise 3.4** as homework.

Nomenclature (Naming) of Hydrocarbons

For this subtopic, it is better to use gapped lecture, group discussion and presentation as active learning methods.

Start teaching the contents in this topic using **Activity 3.3**. This activity helps students to understand the purpose of naming hydrocarbons and guess how one can give name to hydrocarbons. Then let them form groups and do activity 3.3. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Harmonize their discussions by providing answers for activity 3.3.

1. We give specific name to a hydrocarbon using a prefix that indicates the number of carbon atoms it contains and a suffix to show the group it belongs to or functional groups of molecules.
2. The names of hydrocarbons are given systematically. This means that we have to follow certain rules developed by chemists.

After summarizing concepts on activity 3.3, you can briefly introduce to students the prefixes used to indicate the number of carbon atoms in the name of alkanes, alkenes and alkynes as well as their corresponding suffixes. Let them do **Exercise 3.5** as class work independently. After each student completes the exercise, invite some students to come forward and, write their answers on the board. Finally, let other students discuss on the answers given.

Uses of common organic compounds

For this subtopic, brainstorming, gapped lecture and group discussion can be used as active learning methods. You can start this subtopic by asking mention some important organic compounds in our daily life. The students could mention useful organic compounds such as:

- Vinegar (acheto) used to flavour salad;
- Polyvinyl chloride (PVC) and polyethylene used as plastic bottles, bags, cups, plates, shoes, pipes, etc.
- Cow dung used as a fuel for cooking and as fertilizer;
- Soaps and detergents used for cleaning purpose;
- Pain killers and antibiotics used as medicine.

Then, continue to introduce to students the importance of methane, propane and butane, ethyne and ethanol.

Continue teaching using **Activity 3.4**. This activity helps students to understand the purpose of adding of ethanoic acid to salad. Then let them form groups and do activity 3.4. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Harmonize their discussions by providing answers for activity 3.4.

We add vinegar to the salad for flavoring and disinfectant purposes.

After that, continue to introduce to students the importance of formalin.

Finally, you may give **Exercise 3.6** as homework.

Assessment

You can assess students' performance based on your record about each student's performance in discussing from activity 3.2 to activity 3.4, presenting their views after discussion, and answering the question in exercise 3.2 to 3.6.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit.

Additional Questions

*1. Classify each of the following compounds as alkane, alkene or alkyne.

a. C_9H_{20}
b. $C_{10}H_{20}$
c. $C_{12}H_{26}$
d. $C_{10}H_{18}$

2. Write the formula of each of the following compounds.

*a. An alkane containing twenty two hydrogen atoms.

*b. An alkene containing twenty six hydrogen atoms.

*c. An alkyne containing twenty four hydrogen atoms.

d. An alkane containing six carbon atoms.

Answers to Additional Questions

1. a. alkane b. alkene c. alkane d. alkyne
2. a. $C_{10}H_{22}$ b. $C_{13}H_{26}$ c. $C_{13}H_{24}$ d. C_6H_{14}

Answers to Exercise 3.2

1. The formula of alkanes containing 5, 7 and 9 carbon atoms are C_5H_{12}, C_7H_{16}, and C_9H_{20} respectively.

Answers to Exercise 3.3

1. The formula of alkenes containing 6, 8 and 10 carbon atoms are C_6H_{12},

C_8H_{16}, and $C_{10}H_{20}$, respectively.

Answers to Exercise 3.4

1. The formula of alkynes containing five, six, seven and eight carbon atoms are C_5H_8, C_6H_{10}, C_7H_{12}, and C_8H_{14}, respectively.

Answers to Exercise 3.5

1. The students may fill in the Table as shown below.

Number of carbon atoms	Formula of alkane	Name of alkane	Formula of alkene	Name of alkene	Formula of alkyne	Name of alkyne
5	C_5H_{12}	Pentane	C_5H_{10}	Pentene	C_5H_8	Pentyne
6	C_6H_{14}	Hexane	C_6H_{12}	Hexene	C_6H_{10}	Hexyne
7	C_7H_{16}	Heptane	C_7H_{14}	Heptene	C_7H_{12}	Heptyne
8	C_8H_{18}	Octane	C_8H_{16}	Octene	C_8H_{14}	Octyne
9	C_9H_{20}	Nonane	C_9H_{18}	Nonene	C_9H_{16}	Nonyne
10	$C_{10}H_{22}$	Decane	$C_{10}H_{20}$	Decene	$C_{10}H_{18}$	Decyne

Answers to Exercise 3.6

1. a. Alkene b. Alkane c. alkyne d. Alkane e. Alkyne f. Alkene
2. Refer from student's text book.

3.3 Inorganic Compounds

Number of periods allotted: 8 Periods

After completing this section, students will be able to:

- classify oxides into metallic and nonmetallic;
- describe the properties of acidic oxides and basic oxides;
- predict the nature of common oxides;
- prepare sulphur dioxide in the laboratory by burning sulphur in air and use moist blue litmus paper to test its acidic nature;

- prepare magnesium oxide in the laboratory by burning magnesium ribbon in air and use red litmus paper to test its basicity in water solution;
- define acid and base;
- describe properties of acids and bases;
- relate acidic properties to the presence of hydrogen ions and basic properties to the presence of hydroxide ions;
- name and write formulas for some common acids (HCl, HNO_3, H_2SO_4) and bases (NaOH, KOH, NH_4OH), using the periodic table, a list of ions, and rules for naming acids;
- describe how indicators can be used to classify solutions as acidic or basic;
- investigate properties of bases/alkalis experimentally;
- in group, with guidance, prepare their own indicator by extracting the colour from a vegetable, such as beetroot, or flowers and evaluate the indicator;
- investigate household chemicals using locally prepared indicators;
- explain the safety precautions while working with acids and bases;
- create a safety booklet dealing with the handling of acids and alkali;
- identify some everyday uses of neutralization;
- define and give examples of salts.

Forward Planning

Read about inorganic compounds, oxides, types of oxides, properties of oxides, preparation of oxides (SO_2 and MgO), acids, bases, naming and writing formulas of acids and bases, acid-base indicators and properties of acids and bases from the student's text, reference books and other sources to fully understand the subject matter of the lesson. Design a plan to cover the content of the section within a given periods. Make a plan of your own on how to manage students during discussion, presentation, and assessment. In your plan, show the time allotted for group discussion on activities, presentation, for harmonizing concepts, for experiments and other activities. Try out the experiment before the lesson by yourself. Prepare yourself on the activities and exercise before the class.

Teaching Aids

- Necessary chemicals and apparatus required to perform experiments.
- Chart of safety rules in working with acids and bases.

Subject Matter Presentation

You are advised to use discussion, gapped lecture, inquiry, demonstration and experiment as your teaching methods for this subtopic. Use these methods in a way that promotes active learning. Encourage your students to participate in the teaching learning process.

Next, introduce to students that the classification of inorganic compounds into groups (oxides, acids, bases and salts) is based on their composition and properties.

Oxides

For this lesson, inquiry, gapped lecture and group discussion can be used as active learning methods.

You can start this lesson by letting students do **Activity 3.5** in groups. Activity 3.5 is designed to help students to understand concepts of oxides. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Finally, harmonize their discussions by providing answers for activity 3.5.

1. Oxides are binary compounds containing oxygen with any other element. For example, SO_3, BaO, etc. are oxides.
2. No, because unreactive metals (like gold , platinum , palladium)and Noble gases (He , Ne, A r, Kr , Xe and Rn) can not react with oxygen to form oxides.

To check whether or not students have understood the definition of an oxide, let them do **Exercise 3.7** as class work.

Types of Oxides

Continue teaching the lesson by asking students how they can group oxides. After their attempts, tell them the appropriate answer. Give the definitions of metallic and non-metallic oxides using some examples. In addition to that, inform to students the oxides considered as acidic or basic oxides. Give them **Exercise 3.8** as a class work.

Properties of Acidic oxides

You can start this lesson by letting students do **Activity 3.6** in groups. Activity 3.6 is designed to help students to understand the nature of acidic oxides. Facilitate group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Finally, harmonize their discussions by providing answers for activity 3.6.

Oxides of carbon are carbon monoxide (CO) its nature is neutral and carbon dioxide its nature is acidic.

Common oxides of phosphorus are phosphorus (III) oxide or tetraphosphorus hexoxide, P_4O_6 and phosphorus (V) oxide, P_4O_{10} both are acidic in nature.

After that, tell them the properties of acidic oxides by referring student's text book.

Properties of basic oxides

Continue teaching by letting students do **Activity 3.7** in groups. Activity 3.7 is designed to help students to understand the nature of basic oxides. Facilitate

group discussions by clarifying questions raised during their discussion. After the discussion, encourage them to present their answers to the class. Finally, harmonize their discussions by providing answers for activity 3.7.

Oxides of sodium, potassium and calcium are sodium oxide (Na_2O), potassium oxide (K_2O) and calcium oxide (CaO), respectively. All are basic in nature.

After that, tell them the properties of basic oxides by referring student's text book.

Finally, give them **Exercise 3.9** as class work.

Preparation of sulphur dioxide and magnesium oxide

You may use group discussion, experiment and presentation as methodology to teach contents in this topic.

Continue teaching the lesson by introducing the common method of preparing sulphur dioxide and magnesium oxide. This is direct combination of elements (sulphur and magnesium) with oxygen.

After you introduce the method, demonstrate **Experiment 3.1**. The experiment enables them to develop skills how they can prepare acidic oxides and identify their properties. During the demonstration, tell them to watch carefully and record their observations. When you complete the demonstration, tell the students write a laboratory report in groups and then let one or two group representatives present about the experiment to the rest of the class. Make sure that their laboratory report includes the following points on the observation and analysis part of the experiment.

a. Sulphur burns with a blue flame to form sulphur dioxide.
b. The solution changes blue litmus to red
c. $S + O_2 \rightarrow SO_2$
d. Sulphur dioxide is an acidic oxide.

After that, continue to demonstrate **Experiment 3.2**. The experiment enables them to develop skills how they can prepare basic oxides and identify their properties. During the demonstration, tell them to watch carefully and record their observations. When the demonstration is complete, allow them to write a laboratory report in groups and submit it to you for checking. When you check their laboratory reports, make sure that they respond to the questions in the observation and analysis part as follows.

a. To remove dirty particles.
b. Magnesium burns with a bright white flame forming white powder.
c. $2Mg + O_2 \rightarrow 2MgO$
d. Red litmus turns blue.
e. The solution of magnesium oxide is basic.

Finally, you can give them **Exercise 3.10** as homework.

Acids

You may use group discussion, gapped lecture and question and answer as methodology to teach contents in this topic.

You can start the lesson by introducing your students to the second group of inorganic compounds, acids. Bring sample of fruits such as orange, lemon and vinegar for **Activity 3.8**. It is designed for students to understand the prominent property of acids which is common to all. Then, let them form groups and do activity 3.8 in groups for a few minutes. Next, invite some of the group representative's to present their tasting feels to the class. After their presentations, harmonize concepts with the following fact.

1. It has sour taste.
2. It also has sour taste.
3. Yes
4. Yes, because they have sour taste due to the presence of citric acid.

Next, tell them the origin of the word "acid" and explain acids in terms of their properties to release hydrogen ions (H^+) when dissolved in water and give examples.

Bases

Continue teaching the lesson by asking students what are bases. After their attempts, explain bases in terms of their properties to release hydroxide ions (OH^-) when dissolved in water and give some examples.

Naming and writing formula of acids and Bases

To begin to teach the contents of this subtopic, start with **Activity 3.9**. This activity is designed to help students realize formulas of some common acids and bases. Then, let them form groups and do activity 3.9 in groups for a few minutes. When they complete, let some students from different groups present their opinion to the class. After the presentations, harmonize concepts as follows.

1. The formulas of hydrochloric acid, sulphuric acid and nitric acid HCl, H_2SO_4 and HNO_3, respectively.
2. The formulas of sodium hydroxide, calcium hydroxide, potassium hydroxide and ammonium hydroxide are NaOH, $Ca(OH)_2$, KOH and NH_4OH, respectively.

Continue teaching the lesson by asking students what are the rules used for naming acids and bases. After their attempts, tell them the appropriate rules those are used to naming acid and bases by referring students' text or other reference books. Give some examples for each.

Finally, give them **Exercise 3.11** as a class work.

Additional Notes for the Teacher

Naming Acids

An ***acid*** can be described as a substance that yields hydrogen ions (H^+) when dissolved in water. Formulas for acids contain one or more hydrogen atoms as well as an anionic group. Anions whose names end in "-ide" have associated acids with a "hydro-" prefix and an "-ic" ending, as shown in **Table 3.2** from text book.

In some cases two different names are assigned to the same chemical formula. For instance, HCl is known as both hydrogen chloride and hydrochloric acid. The name used for this compound depends on its physical state. In the gaseous or pure liquid state, HCl is a molecular compound called hydrogen chloride. When it is dissolved in water, the molecules break up into H^+ and Cl^- ions; in this condition, the substance is called hydrochloric acid.

Oxoacids are acids that contain hydrogen, oxygen, and another element (the central element). The formulas of oxoacids are usually written with the H first, followed by the central element and then O. We use the following five common acids as our references in naming oxoacids:

- H_2CO_3 carbonic acid
- H_3PO_4 phosphoric acid
- $HClO_3$ chloric acid
- H_2SO_4 sulfuric acid
- HNO_3 nitric acid

Often two or more oxoacids have the same central atom but a different number of O atoms. Starting with our reference oxoacids, whose names all end with "-ic," we use the following rules to name these compounds.

1. Addition of one O atom to the "-ic" acid: The acid is called "per . . . -ic" acid. Thus, adding an O atom to $HClO_3$ changes chloric acid to perchloric acid, $HClO_4$.
2. Removal of one O atom from the "-ic" acid: The acid is called "-ous" acid. Thus, nitric acid, HNO_3, becomes nitrous acid, HNO_2.
3. Removal of two O atoms from the "-ic" acid: The acid is called "hypo . . . -ous" acid. Thus, when $HBrO_3$ is converted to HBrO, the acid is called hypobromous acid.

The rules for naming anions of oxoacids, called **oxoanions,** are

1. When all the H^+ ions are removed from the "-ic" acid, the anion's name ends with "-ate." For example, the anion CO_3^{2-} derived from H_2CO_3 is called carbonate.

2. When all the H^+ ions are removed from the "-ous" acid, the anion's name ends with "-ite." Thus, the anion ClO_2^- derived from $HClO_2$ is called chlorite.
3. The names of anions in which one or more but not all of the hydrogen ions have been removed must indicate the number of H^+ ions present. For example, consider the anions derived from phosphoric acid:

- H_3PO_4 Phosphoric acid
- $H_2PO_4^-$ Dihydrogen phosphate ion.
- HPO_4^{-2} Hydrogen phosphate ion.
- PO_4^{3-} Phosphate ion.

Note that we usually omit the prefix "mono-" when there is only one H in the anion.

Additional questions

Name the following acids.

a. $HClO_4$
b. $HClO_3$
c. $HClO_2$
d. $HClO$

Answers to the additional questions

a. Perchloric acid
b. chloric acid
c. Chlorous acid
d. hypochlorous acid

Acid – Base Indicators

You can start this lesson by revising about acids and bases that they already learnt before this subtopic. Next, introduce to students the definition of acid-base indicators and common indicators used in school laboratories.

Properties of acids and bases

Properties of Acids

Continue teaching the lesson by introducing properties of acids. First, treat the effect of an acid on an acid-base indicator. Then, allow them to do **Experiment 3.3** in groups. When they complete, let them write laboratory report in groups and submit them to you for correction. Make sure that their reports in the observation and analysis part include the following points.

Acid	**Color of the indicator in the acid solution**		
	Litmus	**Phenolphthalein**	**Methyl orange**
Dilute HCl	Red	Colourless	Red
Dilute H_2SO_4	Red	Colourless	Red
Dilute HNO_3	Red	Colourless	Red

Next, proceed to deal with reaction of acids with metals. Write the general equation and give some examples. Then, allow them to do **Experiment 3.4** in groups. When they complete, let them write laboratory report in groups and some groups present their conclusions to the rest of the class. Make sure that their presentations in the observation and analysis part include the following points.

a. Zinc is cleaned with steel wool until it is shiny to remove any coating that hinders its reaction with HCl.
b. Zinc begins to react with the acid (HCl).
c. The formation of bubbles.
d. It is colourless.
e. A popping sound is produced.

f. $Zn\ (s) + 2HCl\ (aq) \rightarrow ZnCl_2\ (aq) + H_2\ (g)$
$Zn\ (s) + H_2SO_4\ (aq) \rightarrow ZnSO_4\ (aq) + H_2\ (g)$

Then, continue to deal with the reactions of acids with carbonates and hydrogen carbonates. Write the general word equation for the reaction and give specific examples. After that, continue with **Experiment 3.5**. This experiment is suggested to assist students develop skills in performing experiments and observe the reactions practically on their own. So, have the students do the experiment in groups. Provide them the materials required for the experiment and assist them whenever they are in need. Tell them to take care since they are working with acids.

When they complete the experiment, let them write laboratory reports in groups and submit them to you for correction. Check that they answered the questions in the observation and analysis part of the experiment as follows.

a. Yes, there is
b. The formation of bubbles indicates that a gas is released from the reaction mixture.
c. The lime water turns milky. This is due to the reaction of calcium hydroxide with carbon dioxide to form calcium carbonate.
d. 1. $CaCO_3\ (s) + 2HCl\ (aq) \rightarrow CaCl_2\ (aq) + CO_2\ (g) + H_2O\ (l)$
.2. $2NaHCO_3\ (s) + H_2SO_4\ (aq) \rightarrow Na_2SO_4\ (aq) + 2CO_2\ (g) + 2H_2O\ (l)$
.3. $Ca(OH)_2\ (aq) + CO_2\ (g) \rightarrow CaCO_3\ (s) + H_2O\ (l)$

Next, continue to deal with the neutralizing effect of acid on bases. Write the word equation for the general reaction and give them specific examples. Then, continue with **Experiment 3.6**. This experiment is designed to help students discover the fact about neutralization reaction on their own. So, let them do it in groups. When they complete, let them write laboratory report and present their findings to the class. Make sure that their presentations in the observation and analysis part include the following points.

a. The solution becomes pink when phenolphthalein is added to it.
b. The colour disappears as a result of complete neutralization.
c. Actually it should not. However, the presence of a single drop of excess acid may affect the colour of blue litmus and change it to red.
d. $NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + 2H_2O\ (l)$

Properties of Bases

Continue teaching the lesson by introducing properties of bases. First, treat the effect of a base on an acid-base indicator. Here it is advisable for you to allow students to perform **Experiment 3.7** on their own in groups. You need only to provide them the necessary materials for the experiment. You should also follow how every group is doing according to the suggested procedures. Help the groups who need assistance. When they complete the experiment, let them write a laboratory report and present their findings to the class. After their presentations, harmonize the concepts suggested by the students with the fact using the information given below.

Base	Color of the indicator in the base solution			
	Red litmus	Blue litmus	Phenolphthalein	Methyl orange
Dilute NaOH	Blue	No change	pink	yellow
NH_4OH solution	Blue	No change	pink	yellow

Therefore, Solutions of bases change the colour of indicators.

Then, continue dealing with the neutralizing effect of bases on acids. Write the general word equation for the reaction of a base and an acid and give them specific examples. Next, allow them perform **Experiment 3.8** in groups. They should do it under your supervision. Provide them with the materials required for the experiment. Assist them whenever they are in need. When they complete the experiment, tell them to write a laboratory report. Invite some students from different groups to present their findings to the rest of the class. After the presentation, harmonize concepts using the following information.

a. The solution stays colourless.
b. Because of complete neutralization of the base with the acid.
c. It does not affect the colour of either blue litmus or red litmus paper. However, addition of a single drop of excess base can cause colour change of red litmus paper to blue.
d. $NaOH\ (aq) + HCl\ (aq) \rightarrow NaCl\ (aq) + H_2O\ (l)$

After that, let them do **Project work** in groups. This project work is designed to help students develop their skills and creativity in preparation of indicators from locally available materials. Here it is advisable for you to allow students to do project work on their own in groups. Give enough days for students. Assist them whenever they are in need. When they complete the project work, tell them to write a project work report. Invite some students from different groups to present their findings to the rest of the class. After the presentation, harmonize concepts using the following information.

1. Light red
2. We have seen the colour changes because of the presence of acidic nature (citric acid) in lemon juice.
3. 'Yes' or 'No' depend upon your work.
4. Natural indicators can prepared from locally available materials.

Characteristics of Good Indicators

- ✓ The colour change must be easily detected.
- ✓ The colour change must be rapid.
- ✓ The indicator molecule must not react with substance being titrated.

Precautions while working with acids and bases Continue teaching to deal with the safety precautions while working with both acids and bases. You better use question and answer methods during your explanation on the safety precautions. After your explanation, continue with **Activity 3.10**. This activity is designed to help students take care when they working with acids and bases. So, have them discuss this activity in groups by reading different chemistry reference books. Give enough time for students. Assist them whenever they are in need. When they complete activity 3.10, invite some students from different groups to present their findings to the rest of the class. After the presentation, harmonize concepts using the following information.

Common precautions when working with acids and bases (alkalis) include:

1. Wearing eye protection (goggle).
2. Wearing protective clothing such as an apron or laboratory coat.
3. Keeping reagent bottles stoppered when not in use.
4. Wiping up all spillages straight away with a wet cloth.
5. Wear shoes that cover your feet
6. Do not smell any chemicals directly!
7. Do not taste any chemical! Even food, drink and chewing gum are prohibited in the chemistry laboratory.
8. Never add water to concentrated acid solutions. Add acid to water carefully.

Finally, give them **Exercise 3.12** as a home work.

Assessment

Assess each students work throughout subunit 3.3. You can assess students' performance based on your record about each student's performance during the teaching learning process. Your records can be based on the participation of each student in:

- discussing activities 3.5 to activity 3.10.
- presenting their views after discussion.

- performing experiments 3.1 to 3.8.
- writing a laboratory report and presenting it to the class
- answering questions during mini-lecture
- answering the question in exercise 3.7 to 3.12.
- answering questions given as quiz or test.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit.

Additional Questions

1. Write the acid anhydrides of the following acids.
   a. H_2CO_3
   b. H_2SO_4
   c. HNO_3

2. Write the base anhydrides of the following bases.
   a. NaOH
   b. KOH

Answers to Additional Questions

1. a. CO_2 b. SO_3 c. N_2O_5, NO_2
2. a. Na_2O b. K_2O

Answers to Exercise 3.7

1. Oxides are binary compounds that contain oxygen.
2. c, d, f, g and h are oxides. a, b and e are not oxides.

Answers to Exercise 3.8

1. basic oxides: a, c and d
   acidic oxides: b, e and f
2. metallic oxides: b, d and f
   non-metallic oxides: a, c and e

Answers to Exercise 3.9

1. a. $CO_2 + H_2O \rightarrow H_2CO_3$

   .b. $CaO + H_2O \rightarrow Ca(OH)_2$

   c. $CaO + CO_2 \rightarrow CaCO_3$

Answers to Exercise 3.10

1. a. $2Mg + O_2 \rightarrow 2MgO$ b. $S + O_2 \rightarrow SO_2$

Answers to Exercise 3.11

1. a. An acid is a substance that releases hydrogen ions (H^+) when dissolved in water. For example, HCl, H_2SO_4, HNO_3,

   .b. A base is a substance that releases hydroxide ions (OH^-) when dissolved in water. For example, NaOH, KOH, $Ca(OH)_2$,

2. hydrogen ion (H^+)
3. The students may fill in the Table as shown below.

Name	Formula	Name	Formula
Hydrochloric acid	HCl	Calcium hydroxide	$Ca(OH)_2$
Nitric acid	HNO_3	Potassium hydroxide	KOH
Sulfuric acid	H_2SO_4	Sodium hydroxide	NaOH

Answers to Exercise 3.12

1. Indicators are substances that show the presence of an acid or a base by undergoing specific color changes when placed in a solution.

Indicator	Colour in acidi solution	Colour in basic solution
Litmus paper	Red	Blue
Phenolphthalein	Colourless	Pink

Methyl orange	red	Yellow

2. a. $2HNO_3 + Na_2CO_3 \rightarrow 2NaNO_3 + H_2O + CO_2$

   .b. $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$

   .c. $2HCl + Zn \rightarrow ZnCl_2 + H_2$

3. a. Washing the eye with plenty of water and then seek medical treatment.

   .b. Drinking a base such as $Mg(OH)_2$ and then seek medical treatment.

3.4 Neutralization Reaction and Salts

Number of periods allotted: 4 periods

After completing this section, students will be able to:

- identify some everyday uses of neutralization;
- define and give examples of salts;
- name and write formulas for some common salts using the periodic table, a list of ions, and rules for naming salts.

Forward planning

Read the contents on neutralization reaction and salts from the student's text and other reference books to fully understand the subject matter of the lesson. Make a plan of your own plan on how to manage students during discussion, presentation, and assessment. In your plan show the time allotted for each activity you are going to perform during every period while you are dealing with this section. Prepare ahead the necessary teaching and learning materials for this topic. Prepare yourself on the activities and exercises before the class.

Teaching Aids

- Table chart that shows names of some acids and group names of their salts (Table 3.4)

Subject Matter Presentation

You are advised to use discussion, inquiry and gapped lecture as your teaching methods for this subunit. Use these methods in a way that promotes active learning. Encourage your students to participate in the teaching-learning process.

You can start the lesson by asking students oral question to tell you what neutralization reaction is. After you get feedback from some students, tell them the reaction of acids with basic oxides or bases to form salt and water is called neutralization reaction.

Applications of Neutralization in Daily Life

After introducing the topic of the section, let the students discuss **Activity 3.11** in groups for a few minutes. This activity is designed to help students develop skills to explore the uses of neutralization on their own. Then, invite some of the groups to present their ideas to the class. After their presentations, harmonize concepts using the following information.

1. You can explain uses of neutralization in different categories such as at home, in health and in agriculture.
2. This is because our shampoo is basic in nature and conditioner is acidic in nature and that is why it neutralizes the effect of the shampoo.

Then, continue to explain about the applications of neutralization at home, in health and in agriculture.

Finally, give them **project work** to do it in groups at least three days before the period you planned to deal with it. This project is designed to help students develop skills in measuring p^H values of different soil samples and treatment of acidic soils. Provide them with the materials required for the project work such as sample holder, PH meter. Assist them whenever they are in need. When they complete, encourage some students from different groups to present their findings to the class. After their presentations, you may harmonize concepts as follows.

The sample which has higher pH value is basic soil and the one which has lower pH value is acidic. The acidic sample is neutralized by adding alkaline (powdered lime, CaO, limestone, $CaCO_3$ or ashes of burnt wood).

Salts

You can start the lesson by asking oral question to tell you what salt is. After you get feedback from some students, continue to explain about salt with examples. Give emphasis that the term 'salt' does not refer only to the salt that we use to prepare our food which is commonly known as table salt.

After giving a short explanation on what salts are, continue to deal with naming and writing formula of salts. Start this lesson deal with **Activity 3.12**. This activity is designed to help students realize formulas and names of some common salts. Thus, have them discuss this activity for a few minutes in groups. When they complete their discussion, invite two students present group's opinion to the rest of the class. After their presentation, you may harmonize concepts as follows.

Name of salt	Formula of salt
Sodium chloride	NaCl
Sodium bicarbonate	$NaHCO_3$
Calcium carbonate	$CaCO_3$

Introduce to students that group names of salts are related to the names of the acids from which they are derived. Mention some examples from **Table 3.5** given in the student text book.

After that, continue to deal with the way how we can get the name of a specific salt. Mention that the first word in the name of the salt is derived from the name of the base, and the second word from the name of the acid. Give some examples. Before you name the salt yourself, let the students attempt to name it.

Name of Base + Name of Acid → Name of Salt + Water

From the equation, allow them to suggest the name of the salt. If they are not able to name the salt correctly, tell them the correct name.

You are also expected to help students how they can identify the acid and the base combinations that form a specific salt from the name of that salt. Give some examples for the students encouraging them to attempt first on their own. When you complete this task, ask students if they can define salt in relation to positive and negative ions. After their attempts, tell them that a salt is a compound containing a positive ion derived from a base and a negative ion derived from an acid.

Next, continue to deal with the way how they write the formula of a specific salt. Mention that the rules that used to write formula of inorganic salts. Give some examples. Before you write the formula of the salt yourself, let the students attempt to write the formula of specific salts.

Finally, give them **Exercise 3.13** as a home work.

Additional note for the Teacher

1. In case of naming salts of binary acids like HCl, HBr, H_2S, HI, etc. you need to drop the prefix 'hydro' and change the ending '-ic acid' to '-ide'. Thus, the second word in the name of the salt becomes; chloride, bromide, suphide, iodide, etc.
2. In case of naming salts derived from ternary or oxy acids such as nitric acid, chloric acid, etc. change the ending '-ic acid' to '-ate' to get the words, nitrate, chlorate, etc.
3. To name salts derived from the acids such as sulphuric acid and phosphoric acid, modify the main word in the name to end in '-ate' to get the words sulphate and phosphate.

Before you conclude this section, give **Activity 3.13** as a group work for the students to do it. You should tell them to do the activity three days before the

period you intend to treat the activity. The activity is designed to help students to develop skills in achieving certain knowledge on their own. You can tell them to prepare the complete table on a chart paper using markers for use during presentation. During the period at which you deal with this part, let some students from different groups produce a five minutes presentation to their classmates. After that, you need to harmonize the ideas suggested by the students with the fact, using the following table.

Name of the salt	Formula of the salt	Uses
Sodium chloride	NaCl	✓ to prepare food ✓ for the manufacturing of sodium, sodium hydroxide and chlorine ✓ to make sodium hydrogen
Sodium bicarbonate	$NaHCO_3$	✓ to make baking powder ✓ in fire extinguishers
Potassium nitrate	KNO_3	✓ as a fertilizer ✓ to make gun powder

Assessment

Assess each student's work throughout subunit 3.4. Your assessment of each student's work can be based on the recorded you have related to his/her involvement in:

- group discussion on activities 3.11-3.13.
- presentation after discussion on activities 3.11-3.13.
- answering questions during lecture or harmonizing.
- doing home work on exercise 3.13.
- answering questions given as quiz or test.

By observing their performances from the record, provide them with feedback to improve students' learning. Appreciate students why are working above the minimum requirement and encourage them to continue working hard. For low achievers, identify their learning difficulties and help them to achieve the minimum required level for this subunit by giving additional exercises or arranging extra lesson time.

Answers to Exercise 3.13

1. refer student's text book
2. a. NaCl b. KNO_3 c. $CaCO_3$

Answers to the Review Exercise on Unit 3

I. **True / False**

1. False
2. False
3. True
4. True
5. True

II. **Multiple Choices**

1. B
2. D
3. A
4. B
5. B
6. C
7. A
8. C
9. B
10. A
11. D
12. C
13. A
14. A
15. D
16. B
17. D

III. **Short Answers**

18. a. C_6H_{10} b. $C_{10}H_{20}$ c. C_8H_{18}
19. a. C_9H_{20} b. C_7H_{14} c. $C_{10}H_{18}$
20. Refer student's text book
21. a. HNO_3 b. Na_2SO_4 c. KOH
22. a. Sulphuric acid b. Calcium hydroxide c. Potassium nitrate

UNIT FOUR

HUMAN BODY SYSTEMS AND HEALTH

Number of Periods allotted:- 30 periods

Unit overview

This unit contains seven sub-units. It starts with the sub unit integumentary systems. It deals first with components, function and disease of integumentary systems. With this it describes about the parts of skin, types of gland, and parts of hair.

The second subunits deal with the human muscular systems. These deals about the common features of muscle, function and types of muscle. It also deeply deals on the disease of muscle.

The third subunit is discussed on human skeletal systems. It talks about the components and their functions of skeleton. In addition to this it also deals on types of bone, types of skeleton, ligaments, types of joint and tendons.

The fourth subunit deals on the digestive systems. It focuses on the structure and components of digestive organ, on types of teeth and on the disease which associated with digestive organs.

The fifth subunit talks on respiratory systems its structural components and function of respiratory organs. It also deals on gas exchange, structure of lung and diseases of digestive organs.

The six subunit is circulatory systems. It deals on components of circulatory systems with their functions. It aalso discusses on different types of organ of circulatory systems. It deals on parts of heart, types of blood vessel, types of blood cell and disease of circulatory systems.

The last subunit is reproductive systems. It deals on male and female reproductive organ with their functions, primary and secondary sexual characteristics of male and female, menstruation and reproductive health.

These all sub-units in this unit are accompanied by a number of activities carried out by students that include discussions, making charts and models and presentations. Thus, you are required to make close and regular follow up of students' involvement every time in the classroom.

In this unit, like the previous three units review questions are given based on competencies in order to help you focus on their continuous assessments and make sure whether the ones set as standard competencies are achieved or not. As usual, you should give special considerations for those who are working above and below the standard levels by encouraging the ones that work above the standard and by giving extra attention for those who work below the standard.

Unit outcomes

After completing this unit, the students will be able to:

- list down the major organs that constitute the human body systems covered in this unit;
- explain the main functions of the major human body systems covered in this unit;
- list down the main diseases or disorders associated with the major human body systems covered in this unit;
- discuss the effects of diseases of the major human body systems covered in this unit.

Main Contents

4.1 Integumentary system

4.2 Muscular system

4.3 Skeletal System

4.4 Digestive system

4.5 Respiratory system

4.6 Circulatory system

4.7 Reproductive system

4.1 Integumentary Systems

Time allotted: 4 periods

1. **Competencies**

After completing this sub-unit, students will be able to:

- display a chart of human integumentary system;
- distinguish the major structural components of human integumentary system;
- describe the main functions of human integumentary system;
- explain, by giving examples, how structure and function are related;
- identify and discuss the main diseases or disorders associated with human integumentary system.

2. **Sub-unit overview**

This sub-unit introduces students to the major components of integumentary systems and their functions, the layers of skin, parts of hair gland and nail, and associated diseases of integumentary systems.

3. **Forward planning**

The process of learning is to be effective by encouraging students' knowledge, skill and attitude. Thus, students have to use any necessary process and activities to acquiring of these learning outcomes. These three are developed by different types of activity. Because of that the knowledge part should be developed by discussion, doing the activities and some exercises. Whereas the skill part should be developed by doing hands on activities. The attitude part could be improved by appreciating the work of scientists.

First prepare lesson plan to these sub topics by including different types of activities which are located in this topics. Correctly arrange the time period according to the topics. Collect and arrange the charts and models and then match it with the given topics. If there are no charts or models try to prepare them by using local materials.

These topics concern on the components, function and diseases of the integumentary systems of human. These systems are the major parts of the body. So at the end of these topics students must understand about the importance of these systems.

4. **Suggested Teaching aids**
   - Use charts, diagrams, and models of the human integumentary systems such as skin, hair and antagonistic functioning of glands that will be made available by your school or students.
5. **Suggested Teaching methods**
   - Brainstorming on the structures and functions of integumentary systems and their importance.
   - Discussions on structures and functions of skin and glands.
   - Reflections on types of human integumentary systems.
   - Demonstration on types of skin, hair and their functions and how they work.
   - More reading in library and working in groups.
6. **Presentation of the lesson**

Start the lesson by asking students to define integumentary systems. Then outline the contents:

- Components of integumentary system
- The three layers of skin
- Functions of integumentary systems
- The three layers of hair
- Segments of nail
- Types of gland
- Major skin diseases and disorders

Starting the lesson by showing the chart and models of human integumentary systems for the students. Then list each part and components of the integumentary systems after observing the diagrams. The students identify and discuss on the components of integumentary systems by using table.

Students list and discuss the parts of integumentary systems with their functions. They identify the characteristics of these systems like layers of skin, hair, parts of nail and types of glands. Students summarize these topics by asking and answering questions about these systems.

Students also list some example of skin disease from their personal experiences before learning these topics. And identify briefly the integumentary disease which is not included in these topics. Finally generalize by doing activity 4.1 to 4.4 and exercise 4.1 in groups and individually.

7. **Assessment and follow up**

You can assess your students by asking them the following questions:

- What are the components on integumentary systems?
- What is the function of integumentary?
- Explain the relationship between hair, nail and skin
- What are rosacea, chickenpox, and latex allergy?
- How you can keep your skin healthy?

Answer for Activity 4.1

1. Show the charts or models of integumentary systems for students in the class then ask to identify and discuss the parts of these systems. And ordered the students to present their discussion results.

Answer for Activity 4.2

- Ordered the students to present the results of their discussion on the skin layers.

Answer for Exercise 4.1

Part I:

1. E
2. B
3. A
4. A
5. B

Part II:

1. The structural components of the integumentary systems and their functions are on your text book on chapter 4 topic 4.1 and 4.2.
   After that you add some information about the skin, hair, nail and glands with their functions.
   Then evaluate the group reports after discussion and give additional information about the above questions.
2. The primary function of human hair is to insulate the human body. It does this in two ways. One it serves as a physical barrier between external cold air and the skin, and in the second it also traps warm air in between the skin and the hair, keeping the body warmer.

Answer for Activity 4.3

1. The students must remember the human skin diseases which are known around their environments. Then they present for the other group of class mate students. The other students listen carefully.

Answer for Exercise 4.2

Part I:

1. C
2. C
3. D
4. D

Answer for Activity 4.4

1. Check the students comparison on skin disease severity
2. When the skin color is become redness it may be the symptoms of the skin diseases like eczema and rosacea then take treatment like washing with cold water daily and you must be going to the nearest clinic.
3. Everybody must take care about their skin by the following methods:-
    1. Washing with cool water daily.
    2. Applying cool compresses
    3. Limiting contact with common allergens
    4. Using wet wipes.
    5. Avoiding poor personal habits like smoking, drinking alcohol etc.
    6. Keeping the affected area covered.
    7. Keeping the skin moist.
    8. Avoiding long time sunlight exposure.

4.2 Muscular system

Period allotted: 4 periods

1. Competencies

After completing this sub-unit, students will be able to:

- display a chart of human muscular system;
- distinguish the major structural components of human muscular system;
- describe the main functions of human muscular system;
- explain, by giving examples, how structure and function are related;
- identify and discuss the main diseases or disorders associated with human muscular systems system.

2. **Sub-unit overview**

This sub-unit familiarizes students to muscular systems, which are the most common known. The students will start studying the features of the muscular structures by investigating the uniqueness of their work and their location in the body. This will give them the chance to inspect the significance of skeletal muscle, smooth muscle and cardiac muscle for the movements of the body. And they can compare and contrast these muscles.

3. **Forward planning**

Because this is the sub-unit within which you are going to introduce the features of human muscular systems and giving more emphasis on the main importance of the muscle with their characteristics. The following are activities you are expected to carry out before starting working on the subunit.

- Look for a model or charts of human muscular system and demonstrates the components of muscle. Show the common structures of human muscular systems.
- Look on the charts to demonstrate the locations of each muscle. Then determine their movements are voluntary or involuntary.
- Look for cardiac muscle and differentiate their work from others.
- Understand about the functions of the muscle in your body.

4. **Suggested Teaching aids**

As teaching resources, use the model or charts of the human muscular systems. Use the textbook as well.

5. **Suggested teaching-methods**

- Brainstorming on the structure of human muscular systems and giving emphasis to the types of muscle.

- Reflections on function of each muscle, difference of cardiac, smooth and skeletal muscle.
- Discussions on general characteristics of muscle, their function and the place of each type.
- Explanations.

6. **Presentation of the lesson**

You can introduce the lesson by asking students what is the unique characteristic of human muscle? What is the difference among different components of muscles? What does it mean Contractility, Excitability, Elasticity and Extensibility and if their other properties between are muscle?

In these topics there is brief discussion of components of muscular systems and their functions. There are three components of muscular systems and each has different functions. There are also the diseases that can affect the components of muscle.

Students first discuss on main features of muscular systems from the observed charts. They also emphasize the issues of muscular contractions. Students also discuss that the advantage of muscle, types of muscle, contraction and relaxation of muscle. Students summarize main features of muscular systems, their components with examples.

Students list down the disease that affects muscular systems. They discuss in groups on the symptoms of muscular dystrophy and others. Students summarize on muscular systems by doing different activity and exercise which include in the topics.

When you start the lesson, ask your students what features make the human muscular systems different from other types of systems in body? Then, ask them if there is similarity between muscle and skeletal systems? If they say similar, what do they think is/are possible reason(s) for similarities? You can motivate your students to discuss on the strengthen of the different types of muscle. You can allow students to discuss the information they have in groups on:

. Voluntarily or consciously of muscle

. Cause of their contractions

. List some function which controlled by skeletal muscle

. Location of smooth muscle

You can give them a short note on the parts of a muscular systems and its significance.

You are advised to stabilize lesson by underlining the following major points. Skeletal muscles are the only muscles that can be consciously control. The contracting of skeletal muscles causes movement of those bones. Most voluntary action is controlled by skeletal muscle. Smooth muscle lines the inside of blood vessels, eye and airway. Cardiac muscle pumps blood around the body by involuntary action.

7. **Assessment and follow up**

You can assess your students by asking them the following questions:

- What features distinguish the three components of skeletal muscle?
- What is character of the smooth muscle?
- Give example about the function of cardiac muscle.

Then after the discussion you evaluate the answers of the students.

Answers for Activity 4.5

Students must discuss on the properties of the muscle cell in their groups. After finishing the discussion they present for other groups and you fill the gaps.

Answer for Exercise 4.3

Part I:

1. Motivate students to remember about the cell structure and functions from their previous class.
2. The students answer to the questions by listing types of muscle with their functions from their previous class.
3. The special properties of muscle that permit movements are contractibility.
4. Put students in groups and ordered to discuss on muscle disease according to their personal experiences presents in class.

Answer for Activity 4.6

1. Listen the discussion of the students on muscle disorders and their presentation in the class. After that you give additional information.
2. When the age is increased the relaxation and contraction of muscle is decreased. (You add additional information for the students).

Answer for Exercise 4.4

Part I:

1/ B

2/ D

Part II:

1/ elasticity

2/ cardiac muscle

3/ muscle disorders

4.3. Skeletal System

Period allotted: 5 periods

1. Competencies

After completing this sub-unit, students will be able to:

- display the charts of human skeleton systems;
- distinguish some components of skeletal systems;
- list and identify the types of bone;
- explain the importance and types of bone;
- explain the most functions of skeleton;
- identify skeletal disorders and disease.

2. Sub-unit overview

The students will start studying the features of the human skeletal systems. They understand the components of skeletal, types of bone and their functions. Then, students will be allowed to discuss the different parts of bone with their functions. Students should be given the chance to inspect the two common types of bone and importance of movable joints. Students understand about ligaments, tendon, and other components of skeletal.

3. Forward planning

Because this is the sub-unit within which you are going to learn the features of human skeletal systems giving more emphasis on components characteristics and their functions. Before starting working on the subunit do the following activities.

- What are the functions of the skeletal
- List some types of bone
- Define the function of joints
- Differentiate between ligaments and cartilage

4. Suggested Teaching aids

As teaching resources, use the charts or model of human skeletal systems from your school. Additionally look the figure 4.27 on your biology textbook.

5. **Suggested teaching-Learning approaches**

- Brainstorming on the structure of human skeletal systems from last year discussions.
- Reflections on function of bone, ligaments and joints.
- Discussions on general characteristics of skeletal systems.
- Demonstrate on human skeletal systems from the given pictures.
- Group discussion on function, structure and components of skeleton.

6. **Presentation of the lesson**

You can introduce the lesson of skeletal systems by asking students how your skeleton muscle works. What are the advantage and main functions of skeletons? What are unique characteristics of human skeleton?

Students discuss main features of human skeletal systems. They emphasize the issue of bone in work of movements. Students discuss on the main parts of skeletal systems, their functions, and also discuss about the difference between long bone and short bone. Students summarize the components of skeletal systems and types of bone.

Students understand their body part movement's front and back like their hand, leg. Students discuss in their groups on the functions of joints on their hand and leg. Students summarize the main functions of skeletal muscles in their groups.

Students list some disease of human which they know before and with their symptoms. Students discuss in groups on the different types of disease of skeletal systems. Generalize the impacts of skeletal disease in their groups.

7. **Assessment and follow up**

Assesse the students by giving group work and individual works. These topics must understand by activity and exercise, discussion, explanation listing and other procedures. The students also clearly done each activity and exercise both in group and individually.

Answer for Activity 4.7:

- The human skeletal systems have great importance for the different activities of human beings. So students deeply explain and discuss in own groups and you supervise their discussions.
- You should show the charts of human skeletal systems. Then the students correctly labelle and record the major bone of the body.

Answer for Exercise 4.5:

Part I: choose

1. C
2. D
3. B

Part III: blank space

1. clavicle and scapula
2. Axial skeleton

Part II: matching

1. C
2. D
3. A
4. B

Part VI: briefly describe

When the baby grows into childhood, much of that cartilage will be replaced by actual bone. But something else happens, which explains why 300 bones at birth become 206 bones by adulthood. Many of your baby›s bones will fuse together, which means the actual number of bones will decrease.

Answer for Activity 4.8

1. The axial skeleton consists of the braincase (cranium) and the backbone and ribs, and it serves primarily to protect the central nervous system. Whereas the appendicular skeleton is one of two major bone groups in the body. The appendicular skeleton is comprised of the upper and lower extremities, which include the shoulder girdle and pelvis.

2. Its functions in supporting the weight of the body and allowing movements of the leg. To provide stability and support to the rest of the body, provide mobility and an upright position.
3. A *joint* is the part of the body where *two or more* bones meet to allow movement. Ball and socket *joint* – the rounded head of *one* bone sits within the cup. Many joints allow for movement between the bones. At these joints, the articulating surfaces of the adjacent bones can move smoothly against each other. However, the bones of other joints may be joined to each other by connective tissue or cartilage. Importantly, joint stability and movement are related to each other.
4. Tell to students to list and discuss skeletal systems diseases briefly.

4.4. Digestive system

Periods allotted: 5 Periods

1. Competencies

After completing this sub-unit, students will be able to:

- distinguish the major structural components of human digestive system;
- describe the main functions of human digestive system;
- identify and discuss the main diseases or disorders associated with human digestive system.

2. Sub-unit overview

These section deals with major components of human digestive systems, how they activate digestion and the types of diseases that related with digestion of food.

3. Forward planning

Prepare lesson plans, prepare diagrams or charts showing human digestive systems that showing different parts of digestive organs.

4. Teaching aids

Charts of human digestive systems, model of human teeth that showing all types of human teeth,

5. Suggested Teaching Methods

Discussion and brainstorming with questions and answers are suggested learning methods. Activities (group and individual) should be used as indicated in the student textbook. Charts of human teeth also used.

Discussion on the process of types of digestion in alimentary canal and demonstration on parts of digestive organ.

6. Suggested presentation

Suggested Active Learning-teaching Guide

Food digestion is the main systems of the body because it is sources of energy for each cell. Mammalian teeth are arranged accordingly to their functions. There are different types of digestive organs in the body with specific functions. There are also associated organs which secret digestive substances.

Start the topic by asking the following questions and share ideas:

- What is a digestion of food?
- Where digestions start?
- Why digestion of food is needed?

Students remember on digestive system and digestive organs according to themselves. Students discuss and describe the main structures of digestive systems by using charts and pictures. Summarize the structural components of digestive system

Students recall and define some parts digestive organ then discuss and describe the main function of stomach during digestion of food. Students summarize the main points and take notes about digestive systems.

Students revise structural components of digestive organ. They identify the types of diseases which infect digestive organs in human being. They also discuss on prevention of digestive organ disease. Students stabilize their understanding and take notes.

7. Assessment and follow up

You assesse the students by giving different types of activities and exercises which are included in the topics. Students must assess individually and in groups.

Answer for Exercise 4.6

Part I: Descriptions

1. Show to your students the charts or diagrams of human digestive systems then command them to labelle and record parts of digestive organ.
2. Students brainstorming on food movement in alimentary canal and discuss well in groups.
3. Ordered students to look their friend's teeth and determine their function, types and numbers in their groups clearly.
4. Students briefly discuss and explain on parts of alimentary canal and present their group results.
5. There are associated glands for digestion of food. So the students observe and labelle the gland and their functions from the charts.
6. Ordered your students to discuss in their groups about the role of teeth.

Answer for Exercise 4.7

Part I:- choose

1. C
2. B
3. C

Part II:- explain

1. The food digestion both physical and chemical digestion in human begins in the mouth.

2. From the small intestine, undigested food (and some water) travels to the large intestine through a muscular ring or valve that prevents food from returning to the small intestine. The undigested food is called faeces. It enters the caecum (large intestine) from ileum and then temporarily stored in the rectum before egestion through the anus.
3. In the stomach, food undergoes chemical and mechanical digestion. Because here, peristaltic contractions (mechanical digestion) churn the bolus, which mixes with strong digestive juices that the stomach lining cells secrete (chemical digestion). Protein digestion starts in the stomach because in stomach there is enzyme which is called protease. This enzyme breakdown protein in to smaller amino acids.
4. Students list and briefly discuss on digestive systems diseases in your groups from their personal experiences.
5. Check students exercise book when they done the given assignment or note.

4.5 Respiratory system

Periods allotted: 5 Periods

1. **Competencies**

After completing this sub-unit, students will be able to:

- distinguish the major structural components of human respiratory system;
- describe the main functions of human respiratory system;
- identify and discuss the main diseases or disorders associated with human respiratory system.

2. **Sub-unit overview**

These sub-unit deals about the major importance of respiration in human beings. It also explains about individual parts of respiratory organ with their functions. In addition to this it also describes about some disease of respiratory organs.

3. Forward planning

Identify reference materials on the topic for guided on detailed functions of respiratory organ. Introduce the students to observe the movements of their some body during inhalation and exhalation. If possible, measure the amounts of exhaled air by using instruments by bringing this from health centers.

4. **Teaching aids**

Pictures which showing the movements of lung during inhalation and exhalation of air. Charts correctly labeled and showing each part of respiratory organs.

5. **Suggested teaching approach**

- Brain storming about respiration of human
- Asking and questions
- Brainstorming
- Demonstration on structure of lung
- Doing exercise and activities

6. **Presentation of the lesson**

Before teaching the main contents of the topics ask students some question about respiratory systems. Then listen their answer and give correction if they are incorrect.

Discussion on the importance of respiration process for the survival of life in all living things including human beings. Remember that how food changes in to sources of energy for the cell. Explain what happen if someone stops respirations.

Before enter in to the main discussion students revise on importance of respirations. Then discuss on the importance of respirations, respiratory organ and functions of lung. Students summarize some of the respiratory organs.

Students list some types of respiratory organ and explain on the major functions of respiration. Discuss on the shape of lung during inhalation and exhalations. Summarizes by listing respiratory gas and explain them. Give examples of respiratory diseases with their symptoms

Memorize some disease from previews topics. Identify some diseases of respiratory organs and briefly explain the prevention methods of them. Finally students summarize the effects of respiratory disease.

7. **Assessment and follow up**

You can assess your students by asking them the following questions:

- How does human respire?
- Which organ is best for respiration?
- What is inhalation and exhalation?
- What is the function of respirations?
- List some example of respiratory disease?

Answer for Activity 4.9

1. Students look the charts of respiratory tract and observe various labelle parts. Then discuss in groups and report the results.
2. Students briefly discuss on respiratory organ and present their discussions.
3. Students briefly explain and discuss in their groups about the role of hair, cartilaginous rings of trachea and alveoli. Then present for the class.
4. There is a variety of respiratory disease and some of these are explain in your textbook under topics on 4.5.3. Major diseases of Respiratory system. Then based on these students list and discuss in the groups.
5. Command students to draw picture of human respiratory tract with correct parts. Then you check that and give some marks.

Answer for Exercise 4.8

Part I:- choose

1. D
2. C
3. C
4. B
5. A

Part II:- explain

1. For exchange of gas in lung, alveoli plays important role. Carbon dioxide from each cell brings on to alveoli by blood vessel and oxygen from environments inhaled through trachea and reach to alveoli. The carbon dioxide removes in to outside in turn oxygen inter to the cell. Therefore, the alveolus is used as a place of gas exchange.
2. Students first make groups and discuss briefly on the inhaled and exhaled air and the way of movements of gas from outside and from inside of the body. Based on these students present their result of discussion. You add some information.
3. In the groups students list and describe respiratory diseases and their effects.
4. COVID 19 is a dangerous respiratory disease throughout the world. Mainly it can be transmitted by close contacts with infected person or other objects. This virus can be carried by air and release in to the environments during in sneezing and coughing. You list additional information about COVID 19.

4.6 Circulatory system

Periods allotted:4 Periods

1. Competencies

After completing this sub-unit, students will be able to:

- distinguish the major structural components of human circulatory system;
- describe the main functions of human circulatory system;
- identify and discuss the main diseases or disorders associated with human circulatory system.

2. Sub-unit overview

These sub-topics deal about the major components of circulatory systems. It also discussed on the parts and elements of circulations and main functions of blood circulations. In this topics also explained about blood vessel, blood cell and other components of circulations.

3. Forward planning

Prepare the chart and diagrams of both systemic circulations and pulmonary circulations. In addition to these show models of the human heart. Identify reference materials on these topics. Demonstrates and labeling the heart chambers.

4. Teaching aids

Heart model, picture show blood flow, model of blood vessel, lung and picture which found on textbooks.

5. Suggested teaching methods

Observing the diagrams of human hearts and correctly calls its four chambers with their functions in the groups. Explain briefly the relationship between blood vessels. Elaborate the functions of blood cells individual and then in groups.

6. Suggested Presentation

Students list some body systems from their previous study about human systems and their functions. Students describe the three main components of circulatory

systems with their functions. Identify the advantage of blood circulations in human body. Students summarizing by listing some types of circulatory components.

Students observe blood vessels and the four heart chambers from the charts of human heart. Students discuss on the functions of blood vessel, left ventricle and right ventricle of hearts. Then identify each valve with their functions. Students summarize the main points of the lesson and take short notes.

Students identify the types of circulatory disorders and diseases then discuss the method of keeping healthy of circulatory organs or elements. Students summaries the four chambers of heart and their functions.

Answer for Exercise 4.9

Part I:- choose

1. B
2. E
3. C
4. D

Part II:- explain

1. Circulation in the body is major transport systems. Because it used to move most substances inside the body like food, gas, minerals, vitamin, hormone and other types from place to place. Large amounts of substances move by carriers of blood.
2. Human circulatory organ have three elements. These elements have great importance for transports of substances. These are blood, blood vessel and hearts. Their functions are listed in your textbook under topic of 4.6.2 functions of circulatory system you can observe from that topic.
3. Students discuss and explain some parts of circulatory systems in their groups and present the results. Then you fill the gap
4. Students also identify and discuss on the three types of blood cell, the four chambers of heart and reason out why human heart is partitioned.
5. Know student discuss in groups on role of heart, blood vessel, blood and blood cells. Then present the reports in class and you fill their gaps.
6. There are different types of circulatory diseases that can cause by different reasons. Some of them are Hypertensions, Heart attack, Strokes and others. Their brief explanations are found on your text book in topic 4.6.3.

4.7 Reproductive system

Period Allotted: 4 periods

1. Competencies

After completing this sub-unit, student will be able to:

- distinguish the major structural components of human reproductive system;
- distinguish between the primary and secondary sexual characteristics;
- describe the main functions of human reproductive system;
- identify secondary sexual characteristics of males and females;
- explain the concept of menstruation and menstrual cycle;
- identify and discuss the main diseases or disorders associated with human reproductive system.

2. Sub-unit overview

In these sub-topics students will know about human reproductive systems, the reproductive organ of male and female, and about their puberty stage. They also understand when secondary sexual characteristics are starts and what their symptoms are. They clearly identify the process of fertilizations in female sex organ and what happen during puberty stages. They emphasize on menstruation.

3. Forward Planning

In each sub-unit the teacher is expected to develop daily lesson plan that can address the minimum learning competencies through an interactive and facilitative teaching learning approach.

4. Suggested Teaching Aids

   - Charts of male reproductive organ
   - Charts of female reproductive organ
   - Models of adolescents male and female or pictures.

6. Suggested teaching methods
   - Brainstorming during starter activities
   - group activity on labeling of male and female reproductive organ

7. Presentation of the lesson

You can start by brainstorming questions such as

- What is the importance of studying about reproduction?
- How is that possible to know period of menstruations?
- How fertilization can occur?
- What is the importance of reproductions?
- What are primary and secondary sexual characteristics?

Learning about reproductive systems is used to understand the mechanism of offspring how it can produce. It also identifies the disease which can be transmitted by unprotected sex and then keep from such diseases.

Students brainstorming about reproductions of human. Students discuss and define male and female reproductive systems. Summarize about male reproductive organ and female reproductive organ briefly. Students should identify primary sexual characteristics of them.

Students should identify the similarity and differences of secondary sexual characteristics among both male and female. Summarize by listing the hormone which control secondary sexual characteristics both in male and female.

Students brainstorming on menstruation from their grade 7 topics. Then discuss briefly about how and when menstruations occurs. Students summarize on ovulation and ejaculation processes.

Students brainstorm on the impact of HIV/AIDS, Gonorrhea, Chancroids and

others diseases on the societies. Students identify the some STDs with their symptoms and summarize the lessons and take key notes on STDs.

Answer for Activity 4.10

1. Ordered students to discuss on the importance of reproduction in human and other organisms. Then they must present their results for the class mates. You give additional information and fill their gaps.

Answer for Activity 4.11

1. Primary sexual characteristics are present at birth and comprise the external and internal genitalia (e.g., the penis and testes in males and the vagina and ovaries in females). Whereas Secondary sexual characteristics are those that emerge during the puberty stages e.g visible secondary sex characteristics include pubic hair, enlarged breasts and widened hips of females, and facial hair on males.
2. You show charts of reproductive systems for students in the class or in laboratory. Then ask students to labelle and observe parts of reproductive organs. Then tell to them to make tables and list the reproductive organs with functions and present in class.
3. Ordered students to discuss bodily changes then compare and contrast between male and female.

Answer to activity 4.12

1. Make the students to discuss and explain in groups about the concepts of menstruation and menstrual cycle.
2. Command students to make groups and identify and explain many reproductive diseases from your personal experiences and present in the class.

Answer for Activity 4.13

1. Ordered students to discuss briefly on the prevention methods of STDs. And they share idea between the groups.
2. Students collect information about the impacts of HIV/AIDS from society. Then present the results in the class.

Answer for Exercise 4.10

Part I:- choose

1. C
2. B
3. A
4. D
5. E

Answer to review Exercise for Unit 4

Part I:choos

1. B
2. C
3. D
4. C
5. A
6. D
7. E
8. B
9. D
10. A
11. D
12. C
13. C

Parts II:- fill the blank space

14. bucal cavity
15. digestion of food
16. crown
17. Pulp cavity
18. emulsification and neutralizations
19. it have hair, mucus, blood vessel and moist
20. alveoli
21. Systemic and pulmonary
22. Artery
23. Testis
24. Menstruations

Part III:- write

25.

- ✓ Good sanitation mechanisms
- ✓ Accepting and using of ABC rules
- ✓ Appropriate use of drugs which are prescribed
- ✓ Check up in clinic and hospitals
- ✓ And others

UNIT FIVE

ECOSYSTEM AND CONSERVATION OF NATURAL RESOURCES

Total Period Allotted: 33 periods

Unit overview

This unit is designed to help students to explore and know about environment and its characteristics. The unit helps to describe how living organisms interact with each other and with their environment. This unit has two sub-units; Definition and Components of ecosystem and conservation of natural resources.

The first sub unit entitled as definition and components of ecosystem, is clearly define ecosystems and list components of ecosystems with their definitions. There are two types of components namely biotic and abiotic components.

The second sub-unit explains how to conserve and protect natural resources in the environments. There are many numbers of natural resources and they must be conserved for future uses.

Under such types of sub-unit there are also other sub-topics which elaborate sub-units.

At the end of the unit students will be assessed based on the minimum competencies given on each sub-unit.

Unit outcomes

After completing this unit, students will be able to:

- define ecosystem and components of ecosystem;
- identify and describe the types of biological interactions of organisms in an ecosystem;

- construct simple food chain and explain its components;
- differentiate between food chain and food web;
- distinguish between the different components of food chain;
- describe the role of nutrient recycling in nature;
- explain how energy flows from producers to consumers;
- explain why nutrients are said to recycle while energy flows (does not recycle);
- summarize the characteristics of soil;
- describe the various types of soils;
- explain the various uses of soil in nature and to human being;
- list down and describe the various soil conservation strategies;
- engage in the Environment Club of School and participate in awareness creation campaigns;
- explain the various uses of soil in nature and to human being;
- list down and describe the various water conservation strategies;
- describe the various components of atmospheric air;
- identify and discuss the various human activities that cause air pollution ;
- discuss the impacts of air pollution with examples;
- explain the various uses of air in nature and to human being;
- explain the cause and impacts of global warming;
- list down and describe the various actions that can be taken to reduce the emission of carbon dioxide to atmosphere;
- define forest and give examples of natural forests in Ethiopia;
- explain the various uses of forest in nature and to human being;
- identify and discuss the various human activities that cause deforestation;
- discuss the impacts of air pollution with examples;
- devise and coordinate various forest conservation actions;
- organize groups that would campaign to teach the community on environmental protection;
- organize plantation campaigns in their school compound and its environs;
- list and describe the values of biodiversity;

- list down and describe the various in-situ and ex-situ conservation strategies in biodiversity conservation;
- give examples of the various indigenous knowledge and practices that are used in the conservation of various natural resources such as soil, forest, etc.

Main Contents of the chapter

5.1 Definition and Components of ecosystem
5.2 Conservation of natural resources

Planning for the Unit

The unit requires the teacher to assess the ecosystems for appropriate group work and field work around the school and/or village in relation to lesson before the session starts depending on the specific need of the sessions. The teacher should design the overall picture of the unit using a model or a diagram to illustrate what the ecosystems looks like and what it contains.

5.1 Definition and Components of ecosystem

Period allotted: 11 Periods

1. Competencies

After completing this sub-unit, student will be able to:

- *D*efine ecosystem and components of ecosystem;
- Identify and describe the types of biological interactions of organisms in an ecosystem;
- Construct simple food chain and explain its components;
- Differentiate between food chain and food web;

- Distinguish between the different components of food chain;
- *D*escribe the role of nutrient recycling in nature
- Explain how energy flows from producers to consumers
- Explain why nutrients are said to recycle while energy flows (does not recycle)

2. Sub-unit overview

This sub-unit familiarizes students with the definition of ecosystems, its characteristics and scope. In the sub-unit students know new terms like biotic, interaction and decomposers with the necessary examples and demonstrations. Furthermore, students will differentiate the types of components and the various types of autotrophs and heterotrophs within an ecosystem.

3. Forward Planning

In this sub-unit the teacher is expected to develop daily lesson plan that can address the minimum learning competencies by using additional materials.

4. Suggested Teaching Aids

Observe the environments around the school compound which contain living and nonliving things. Identify their relationships.

5. Suggested teaching methods

- Field work to examine an ecosystems
- discussion in groups based on their observations
- Brainstorming for all starting activities
- List some of biotic and abiotic components
- Summary lesson on key points.

6. Presentation of the lesson

Ask students to explain about the definition and effects of ecosystems in their surroundings from their brainstorming. Identify the types of causative agents which make the environment disappeared and how to control these causes. Ask students to give some examples of interaction in ecosystems when they observe around their surroundings.

Make students to be the main factors in order to natural resources conservations by explain its advantage for them. Make awareness for students about the importance of both ecosystems components.

Before starting the lessons students must explain some terms of these topics. Then brainstorm on the importance and relevance of knowing about components of ecosystems. Students discuss and define on the characteristic and types of ecosystems components and their relations between each other. Students list types of biological interactions and their advantages for population and give example from their surroundings.

Students list the types of organisms based on their nutrition systems. Students identify and grouping the feeding systems of the domestic animals including themselves. Students list out the different types of trophic level and give examples.

Students briefly explain and identify food chain and food web with example. They also identify the trophic level up to fourth trophic level. Clearly discuss on the difference between producer and consumers. Finally they summarize by taking short notes and perform the given activities. Students identify the shape of trophic pyramids and also examine on the types of pyramid and draw the pyramids. Summarize by list types of pyramid.

Students brainstorm on the nutrients and the way of their cyclic from their previews session of food we and chain. Students discuss in groups about the cycle of elements in their surroundings. Identify how energy is flow and why it is not cyclic. Students summarize on the cycle of nitrogen, oxygen, carbon in groups.

Additional Notes

The nitrogen cycle is a repeating cycle of processes during which nitrogen moves through both living and non-living things: the atmosphere, soil, water, plants, animals and bacteria. This atmospheric nitrogen must convert to ammonia and nitrates.

Decomposers can break down protein which is found in wastes and in dead body of plant and animals in to ammonium compounds.

Denitrification is reduction of nitrate back to inert nitrogen gas (N2) completing the nitrogen cycle. This process is performed by pseudomonas and clostridium bacterial species in anaerobic conditions.

7. Assessment and follow up

Students are expected to work on activity 5.1, exercise 5.1, exercise 5.2, activity 5.2 and 5.3 then submit to their teacher for correction.

Answer for Activity 5.1

1. Motivate students to explain and present about the way of understanding their ecosystems.
2. An ecosystem can be categorized into its abiotic constituents, including minerals, climate, soil, water, sunlight, and all other nonliving elements, and its biotic constituents, consisting of all its living members. An ecosystem is a group or community composed of all its living members and non-living or abiotic constituents, including minerals, climate, soil, water, sunlight, and all other nonliving elements, and their interactions with each other. Students present their works in the class.
3. Students must summarize on the most types of biological interactions in their groups and then present in the class. (Hint: Biological interactions are the effects organisms in a community have on one another. In the natural world no organism exists in absolute isolation, and thus every organism must interact with the environment and other organisms).

Answer for Exercise 5.1:

Part I:- choose

1. A
2. C
3. B
4. A
5. D

Part II:- explain

1. In the ecosystems both biotic and abiotic factors are very important for the continuity of ecosystems. There is interaction between them and that determine the presence and absence of ecosystems. Biotic components are living things and their products then they may be used as food. If its level decreases the availability of other components also reduce. In other ways, abiotic factors are nonliving things and that are the major factors for the distribution of organisms. Such may be soil; water, temperature etc. for example, if the fertility of soil increases the presence of vegetation also increase in the ecosystems. Also some organism need cool environment and others need warm thus it greatly determine the ecosystems. You add the other factors.
2. Nonliving things affect the distribution of organisms in the ecosystems like fertility and type of soil, amount of temperatures, land topography and others.
3. Before you explain students try to compare and contracts briefly.

Advantage:- a pair of organisms living together. Commensalism benefits one organism and the other organism is neither benefited nor harmed. When one organism takes benefits by interacting with another organism by which the host organism is not affected. Cooperative relationships between species that result in better growth, reproduction, and survival for at least one species involved in the interaction, without negatively affecting the other species

Disadvantage:- one of the interacting populations is benefited and the other is harmed. In negative interaction one population may eat members of the other population, compete for foods or excrete harmful wasters. Examples of limited

resources can be food, a space to live, or even sunlight. Interspecific competition can result in a negative interaction if the competing species fight and kill each other for the limited resource.

In some types of interaction both are benefited and they can survive for the future. It is its advantage. But in others there is one or both are harmed and it reduces their numbers. It is its disadvantage. You must explain the other factors.

4. Students most go to the school compounds and identify biotic and abiotic components with their functions and briefly understand them at the end the report their findings.

Answer for Exercise 5.2

Part I:- choose

1. C
2. C
3. C
4. B

Part II:- explain

1. Food web **food chain**

- More complex - not complex
- Have more than one chain -have only one chain
- Contain large number of organism -contain small no. of organisms
- Network of feeding -simple feeding systems

You must add more information.

1. Decomposers play a critical role in the flow of energy through an ecosystem. They break apart dead organisms into simpler inorganic materials, making nutrients available to primary producers. First, they act as a cleansing agent of the environment by decomposing dead plants and animals. · They help in recycling the nutrients. Some part of the simple substances is reabsorbed by decomposers and the remainder is left in the environment for recycling. They feed on the dead and decaying bodies of plants and animals.

Answer for Activity 5.2

1. A food web and food chain consists of several components; primary producers, primary consumers, secondary consumers, tertiary consumers, and so on. Primary producers include green plants and are the foundation of the food web. Through photosynthesis, primary producers capture some of the Sun's energy. Plants – 'base' of the food chain.
    - Herbivores – feed on plants; many are adapted to live on a diet high in cellulose.
    - Omnivores – feed on both plants and animals.
    - Carnivores – feed on herbivores, omnivores, & other carnivores.
    - Decomposers.
2. photosynthesis is the process by which green plants make their own food. In this process oxygen which is vital for breathing systems released. Also by these process the food which is very important all living organisms synthesized.
3. Ordered students to present the results of their discussions. (Hint: Populations decrease at higher levels of the food chain because they require more energy from other organisms and because of loss of energy at each trophic level. Decreased energy levels at higher trophic level can complement the survival of less number of organisms as compared to the lower trophic level. Thus, the number of organisms decreases as we move from producers to the consumers in a food chain. It is important to recognize that the higher on the food chain one looks, the fewer the number of organisms that occupy that level. This is because of the energy that is available from one level to the next has to decrease since it is used for life's processes).

Answer for Exercise 5.3

Part I:- choose

1. D
2. C
3. A
4. D
5. D

Part II:- explain

1. Students briefly explain and discuss on the role of decomposers in nutrient cycle. Then they must bring the reports for the class mate and after you give additional information.
2. Energy flow is the flow of energy through living things within an ecosystem. All living organisms can be organized into producers and consumers. Next, energy and matter move up the trophic levels of an ecosystem as producers are eaten by primary consumers, which are then eaten by secondary consumers, and so on. So, the energy that enters an ecosystem as sunlight eventually flows out of the ecosystem in the form of heat. Energy decreases as it moves up trophic levels because energy is lost as metabolic heat when the organisms from one trophic level are consumed by organisms from the next level.
3. First listen the student's presentations then you add the following information.

   That means that energy can neither be created nor be destroyed. It can only be converted or transformed from one form to another. For example, when we cycle, muscular energy is transformed to mechanical energy while peddling. This is why we say energy "flows". In an ecosystem energy is flow at every stage and it can't be reversed to its initial (in starting) quantity. As energy moves through an ecosystem, it changes form, but no new energy is created.

5.2. Conservation of Natural Resources

Period allotted: 21 Periods

1. *Competencies*

After completing this sub-unit, student will be able to:

- summarize the characteristics of soil;
- describe the various types of soils;
- explain the various uses of soil in nature and to human being;
- list down and describe the various soil conservation strategies;
- engage in the Environment Club of School and participate in awareness creation campaigns;
- explain the various uses of soil in nature and to human being;
- list down and describe the various water conservation strategies;
- describe the various components of atmospheric air;
- identify and discuss the various human activities that cause air pollution;
- discuss the impacts of air pollution with examples;
- explain the various uses of air in nature and to human being;
- explain the cause and impacts of global warming;
- list down and describe the various actions that can be taken to reduce the emission of carbon dioxide to atmosphere;
- define forest and give examples of natural forests in Ethiopia;
- explain the various uses of forest in nature and to human being;
- identify and discuss the various human activities that cause deforestation;
- discuss the impacts of air pollution with examples;
- list down and describe the various actions that can be taken to conserve forests;
- list and describe the values of biodiversity;
- List down and describe the various in-situ and ex situ conservation strategies in biodiversity conservation;
- Give examples of the various indigenous knowledge and practices that are used in the conservation of various natural resources such as soil, forest, etc.

2. Sub-unit overview

In this sub-unit, students will have learn more about the types of resources and their importance with examples. They will know about how natural resource is conserved. Get information on soil type fertility and its texture for advantage of plants. They also being understand on the water, air and forest conservation mechanisms. Get knowledge on importance of biodiversity and their management systems. They are will become familiar indigenous knowledge and conservation of natural resources.

3. Forward Planning

In each sub-unit the teacher is expected to develop daily lesson plan that can address the minimum learning competencies through an interactive and facilitative teaching learning approach.

4. Suggested Teaching Aids

- Sample of soil, water, plant

5. Suggested teaching methods

- Brainstorming during starter activities
- Site seeing and group activity of soil texture type
- Summary of key points will be given during conclusion.
- Discussion
- Explanation
- Ask and questions

6. Presentation of the lesson

You can start by brainstorming the students on their environments like:

- Brain storm on what type of soil found in your environment?
- Which soil is more preferable?
- How water is conserved?
- List some example of biodiversity.
- What is deforestation and afforestation

It might be possible to observe the forests around their environments. They also understand about different types of natural resources and their importance for living things. Use indigenous methods for conservations of such resources.

Students brainstorming about their surrounding and discuss on the function of air and water for life. Explain on the methods of conservations. Students summarize by listing natural resources.

The student must explain function of soil from their personal knowledge and going to fields to observe the structures of soil. Identify types of soil which are more useful. Carryout some methods of soil conservation systems and summarize on the characteristics of soil.

Students brainstorm and list out some importance of water for living organisms. They discuss how water pollution is occurring. Then list out some prevention methods and identify the water body. Students conclude by explaining the impacts of water pollutions on living and nonliving things.

Students list the components of air in the atmospheres. Brainstorming on the advantages of oxygen for living things. Students list air components and identify which is more useful. Explain the effects of carbon dioxide in greenhouse gas. Doing activity 5.4. and summarize by comparing and contrasting the air compositions.

Students brainstorm how forest is reduced in their surroundings. Describe and discuss on the reason and impacts of deforestations. They brain storming on the activity of community towards deforestations. Students summarize advantage of forests by list them.

Students discuss briefly on the methods they would use to manage biodiversity. They identify the different types of method to conserve biodiversity. In the next they discuss on the functions of biodiversity. Identify and explain in-situ and ex-situ conservations methods.

Students brainstorm the indigenous method of conservation. Students identify and explain some types of indigenous methods of conservation. Students summarize the lessons and take key notes on conservations.

Additional Notes

Reforestation is the process of planting trees in a forest where the number of trees has been decreasing. It's helping to bring forest back to an area where it was destroyed. Trees are an important component of the environment. They clean the air, cool it on hot days, conserve heat at night, and act as excellent sound absorbers.

The term bio diversity or biological diversity refers to the collection of life and habitat in ecosystems. Biological diversity includes variations in the way of species.

The maintenance of species and ecosystems is a keystone to sustainable development. Therefore, the protection and efficient management of wild species and their environment is the prime objective of conservation.

7. Assessment and follow-up

Students should be evaluated in continuous assessment method based on the objectives set. The teacher should observe students during group discussion and encourage all to participate during the discussion.

Answer for Activity 5.3

1. Ordered the students to bring some types of soil from their surrounding and observe the color, size, texture etc. Then discuss in groups briefly about their observation.
2. Motivate and stimulates the students to take part in soil conservations programs around their home and schools.
3. Tell students to demonstrate on soil ability of water holding capacity. First they bring the three samples of soil and water from the surroundings. Put types of soil individually and add some water gently on each type. Then observe the results carefully and do reports on which type of soil pass water, which is intermediate and which is hold more water and then discuss on the results. (Hint: clay soil holds more water, Sand does not hold any water and loam soil is intermediate).

Answer for Activity 5.4

1. Students brainstorming and discuss briefly on the importance of water for living things and present for the class mates.
2. There are many activities which cause water pollutions. So students list and discuss on human activity which cause water pollutions and their conservation methods.
3. Motivate and initiate students to participate in celebration of water conservation day on 22nd March around their home and school.

Answer for exercise 5.4

1. Loam soil is the most fertile soil. Because loam soil contain more nutrients, moisture, and humus and have better drainage of water and air, and are easier to till. It's texture and its ability to retain nutrients and water are helpful and it is suitable for growing plants. Fertile soils teem with life.
2. Before you explain the function of soil students must list some types of soil with their specific functions. For example:-

✓ Sandy soil is usually dry, nutrient and fast draining. It is used for plowing, planting and cultivating.

✓ Clays are the source of many of the chemical and physical properties of

soils that make them a useful medium for the growth of plants and for the less common uses such as a medium for the disposal of wastes.

✓ Silt soil is usually more fertile than other types of soil, meaning it is good for growing crops. Silt promotes water retention and air circulation.

3. Students must brainstorming on loss of soil fertility and their conservations methods.
4. Initiate students to participate and engage in environmental protection club in school and their villages.

Answer for Activity 5.5

1. Students brainstorm on the advantage of air for all living things.
   Air encompasses oxygen which benefits in respiration of all living creatures. It also includes carbon dioxide which aids in execution of photosynthesis by plants. It comprises nitrogen which is transformed into practical form to be used up by plants. Hence, air supports all life on the earth.
2. Students discuss and explain about the impacts of human on air pollutions. They also list and explain the prevention methods.
3. Students briefly explain the impact of air pollution for living and nonliving things and then also put the way of reduction of these impacts.

Answer for Activity 5.6

1. Students brainstorm and briefly discuss how plantation reduces carbon dioxide and global warming from the atmospheres. (Hint: As trees grow, they help stop climate change by removing carbon dioxide from the air, storing carbon in the trees and soil, and releasing oxygen into the atmosphere. Trees provide many benefits to us, every day. As the trees grow they pull in CO2 through their leaves and convert it into carbohydrates, which they use to grow. So long as a tree lives, that carbon stays within it – and trees can live for decades or centuries. Trees are a natural "carbon sinks".
2. Students list and discuss on the advantage of photosynthesis for air pollutions.
   Plants improve air quality through several mechanisms: they absorb

carbon dioxide and release oxygen through photosynthesis, they increase humidity by transpiring water vapor through microscopic leaf pores, and they can passively absorb pollutants on the external surfaces of leaves and on the plant root-soil system.

Answer for Activity 5.7

1. Student brainstorm on the functions of forests present in class. Then you add the following notes: The importance of forests cannot be underestimated. We depend on forests for our survival, from the air we breathe to the wood we use. Besides providing habitats for animals and livelihoods for humans, forests also offer watershed protection, prevent soil erosion and mitigate climate change.
2. Students brainstorming on way of deforestations and discuss conservation methods then present for the classmate. Then you fill the gape Deforestation happens for many reasons, such as logging, agriculture, natural disasters, urbanization and mining. There are several ways to clear forest, burning and clear-cutting the land are two methods.

Answer for Exercise 5.5

1. Command students to list some example of organisms for each of the five kingdoms in their groups. Then you fill the gaps of the students by giving examples.
2. Students list, discuss and explain some examples of national park and zoos in Ethiopia. Then present the reports for the classmates.
3. Ask the students to collect any indigenous practice from their parents other persons that used to conserve natural resources and present in the class.

Answer for Exercise 5.5

Part I: choose

1. B
2. B
3. E
4. D

Part II: matching

1. C
2. A
3. B
4. E
5. D

Parts III: blank space

1. Forests
2. In-situ
3. Indigenous knowledge

Answers to Unit end questions

Part I: choose the best answers from the given alternatives

1. D
2. B
3. C
4. D
5. D
6. D
7. A
8. D
9. C
10. C
11. B
12. E
13. B

Part II: fill in the blank space

1. Soil texture
2. Plantation or afforestation or reforestations
3. Water pollution
4. Nitrogen
5. Pollutant
6. Forests

Part III: short answers

1. **Water conservations**

1. Cover vegetation:- vegetation used to absorb and hold water. It reduces the rune off and decrease force of rain drops allowing the rain fall to reach the ground gently.
2. Contour ploughing:- is ploughing the hill across the slope but not up and down. It prevents waters from running off.
3. Terracing:-collect water in the channel and prevent erosion and increase the crop yield.
4. Building artificial mechanical barriers, check dams prevent running off.
5. Preventing water pollution by educating people and formulating water policy.

2. Air conservations

- Avoid use of traditional fuels
- Using solar wind and hydroelectric powers
- Reforestation or planting trees
- Take care for air pollutions
- Educating society
- Establish law of pollution control etc peoples must prevent pollutions.

2. Air can be polluted by different activity of human. Some of these activities are

- ✓ Deforestations for different purposes which reduce vegetation in turn CO_2 increase in atmospheres and cause pollutions.
- ✓ Release of smoke from burning substances and that smoke contain toxic gas which actively join with air and polluted it.
- ✓ If vegetation level decreases by human activity, CO_2 in the air increase and it cause air pollutions.

3.

- Economic—biodiversity provides humans with raw materials for consumption and production. Provisioning services—the production of food, fiber and water. Many livelihoods, such as those of farmers, fishers and timber workers, are dependent on biodiversity.
- Ecological life support—biodiversity provides functioning ecosystems that supply oxygen, clean air and water, pollination of plants, pest control, regulating services—the control of climate and diseases wastewater treatment and many ecosystem services.
- Recreation—many recreational pursuits rely on our unique biodiversity, such as bird watching, hiking, camping and fishing. Our tourism industry also depends on biodiversity.
- Cultural—cultural services—such as spiritual and recreational benefits.
- Scientific—biodiversity represents a wealth of systematic ecological data that help us to understand the natural world and its origin.

UNIT SIX
THE SOLAR SYSTEM

Time allotted to the unit: 22 periods

Learning Outcomes: At the end of this unit, learners will be able to:

- Understand the concept of solar system.
- Differentiate movement of planets and satellites in the solar system.
- Understand the unique characteristics of earth and planets.

Contents of the Unit

Unit 6: The Solar System

6.1 Family of the Solar System *(5 Periods)*

6.2 Formation of the Solar System (Planets Satellites, Other objects) *(6 Periods)*

6.3 Earth in comparison with Solar system. *(6 Periods)*

6.4 Our planet's suitability for life (uniqueness) *(5 Periods)*

Unit Overview

This unit deals about solar system. Families of the solar system, the formation of the solar system and the unique characteristics of Earth for life need to be discussed in order. Students should be encouraged to do the model of the solar system in group. Based on the model they did, the position, size and behavior of the planets could be discussed. All comparisons (distance, position, and size) is better to discuss using the model.

6.1 Family of the Solar System

Proposed number of periods: 5 periods

Learning Competencies

By the end of this section students should be able to:

- explain family of the solar system;
- name all planets in the solar system;
- show the position of each planet in the solar system;
- develop the model of solar system.

Suggested teaching methods

- Discussion
- Explanation
- Question and answer
- Using models
- Animations and simulations
- Field work

Forward Planning

This section deals about the families of the solar system. The teaching approach should be student centered (active learning). For this reason by using question and answer method you should be able to check your students' engagement in the learning process. The definition of the solar system has to be seen first. Then one by one all families of the solar system: planets, dwarf planets, satellites, asteroids, comets and meteors should be discussed in order. Attention should be given to Sun because it is the source of energy for all planets. The position, size and behavior of each planet should be explained.

The difference in the position, size and behavior of inner and outer planets should be discussed.

In addition the material from which the inner and outer planets are made should also be mentioned.

In order to boost the attitude of students in appreciating the work of scientists let students read the history of Edmund Halley and that of Galileo Galilei. You can also make a discussion on their contribution to science. Knowing the contribution of Scientists like Edmund Halley and Galileo Galilei helps to boost the attitudes of students towards Science.

Then the discussion about dwarf planets continues. The distinction between planets and dwarf planets need to be mentioned. This is followed by the discussion of terrestrial or inner planets and the Jovian or outer planets. The difference in their position and behavior should be discussed.

The behavior of other members of the solar system (Asteroids, comets and Meteors) is then discussed.

Teaching Aids

The following teaching aids are suggested to be used.

- Picture of the solar system.
- Model of the solar system

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

Start by asking students what they know about solar system, the Sun, planets, satellites and other bodies in the solar system. Based on the background of the students prepare a discussion on the families of the solar system. You can ask the following questions.

- Mention the families of the solar system.
- What is the center of the solar system?
- The importance of Sun for life on Earth.
- Locate the position of each planet in the solar system.

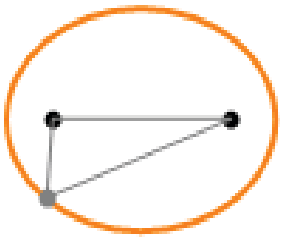
Introducing the key words is important so that students will put on their mind and give attention during discussion.

The position, distance, number of moons, rotation time and behavior of each planet should be discussed.

Use Activity 6.1 to explain that each planet is revolving around Sun on its path. Let each student hold a paper on which the name of the planet they are representing is written. While students are moving on their path, they won't collide with each other indicating that the planets will not also collide with each other while they are revolving around Sun.

Your assistance is important in constructing the model. How the scale of converting real distances to that given in the model should be discussed. Here are the steps in drawing an ellipse using two nails and a string.

First place two nail firmly some distance apart on your paper. The two ends of the string are attached to two nails. The pencil is moved all the way around the figure while always keeping the string tight. The nails are driven at the foci (plural of focus) of the ellipse, which are located on the long axis at equal distances from the center, see the figure.



Project 6.1: can be used to increase students' interest in the topic. First you look Venus. Then tell them at what time and in what position they could see Venus. The next day ask them what they have seen.

Project 6.2:

The definition of a planet was revised again in 2006 by the International Astronomical Union (IAU). They define a planet as a celestial body that:

1. Is in orbit around a star, but is not itself a satellite
2. Has sufficient mass so it is nearly spherical in shape
3. Has cleared the neighborhood around its orbit

Since Pluto didn't satisfy this definition of a planet it is rejected from the list of planets.

Project 6.2 can be taken as a reading assignment. You can arrange some of the students to present a report about what they have got from their reading.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

6.2 Formation of the Solar System

After completing this section learners should be able to:

- Describe how satellites move around the Earth.
- Explain the motion of large bodies in the solar system.
- Differentiate the motion of satellites and planets in the solar system.

Suggested teaching methods

- Discussion
- Explanation
- Question and answer

Forward Planning

This section deals about the formation of the solar system. The birth of the Sun, planets and other families of the solar system should be discussed in order. Then the behavior of the motion of satellites would be discussed.

Teaching Aids

The following teaching aids are suggested to be used.

- Picture of a satellite.
- Picture of motion of satellite around Earth.

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

Scientists view about the formation of the solar system is a bit challenging to understand. Try to show the process of the solar system formation step by step. You better start from the formation of the Sun, then to the formation of planets and other bodies in the solar system.

The order and arrangement of the planets and other bodies in our solar system is due to the way the solar system formed. Nearest the Sun, only rocky material could withstand the heat when the solar system was young. For this reason, the first four planets-Mercury, Venus, Earth and Mars are terrestrial planets. They are small with solid, rocky surfaces. Meanwhile, materials we are used to seeing as ice, liquid or gas settled in the outer regions of the young solar system. Gravity pulled these materials together, and that is where we find gas giants Jupiter and Saturn and ice giants Uranus and Neptune.

Then the definition of satellites, both natural and artificial satellites, and their motion around planets should be discussed. The comparison of the motion of satellites and the motion of planets should be discussed. Satellites are classified into two: natural satellites and artificial (man-made) satellites. Here the difference between a satellite and moon need to be discussed. In addition the motion of satellites and planets should be compared and discussed.

A group discussion on the mission of the two Ethiopian satellites is important. If you can it would be nice if you could arrange a trip to Visit the work of the Ethiopian Space Science and Technology Institute (ESSTI) at Entoto Observatory and Space Science Research Center (EORC).

Students should appreciate the work of the Ethiopian Space Science and Technology Institute (ESSTI) and that of the government for launching two satellites. The mission of launching these satellites needs to be discussed. Students should be asked their interest to be an astronomer in their future carrier.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

6. 3 Earth in Comparison with Solar System

After completing this section learners should be able to:

- compare the distance, size, position and behavior of each planet from the Sun.

Suggested teaching methods

- Discussion
- Explanation
- Question and answer
- Using models

Forward Planning

This section deals with comparing the distance of each planet from the Sun, the size of Earth in comparison to other planets, and the behavior of each planet from the Sun.

Teaching Aids

The following teaching aids are suggested to be used.

- Picture of the Solar System.
- Model of the Solar system.

Suggested teaching methods;

- Discussion
- Using models
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

Here comparing the distance, position, size and behavior of Earth relative to other planets is discussed. For this purpose constructing the model of the solar system is mandatory.

In comparing the distance, size, position and behavior of Earth relative other planets in the solar system, using a model is important, project 6.3. One model can serve for all comparisons. Arrange students with appropriate number of group members. Give them enough time and support while they are doing the model. If your school has a playground you better take them there. Otherwise you can do it in the class using a string and a bead.

Students may need your assistance in determining the scale for distance and size of the planets relative to Earth.

Once the model is constructed carefully, every discussion should be made using it.

Exercise 6.4 and 6.5 serves to summarize what you had discussed up to now, about the behavior of each planet.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

6. 4 Our planet's suitability for life (uniqueness)

After completing this section learners should be able to:

- explain the unique characteristics of Earth;
- describe the suitability of Earth for life;
- compare the distance, size, position and behavior of each planet from the Sun.

Suggested teaching methods

- Discussion
- Explanation
- Question and answer

Forward Planning

This section deals about the conditions that made Earth suitable for life, and the unique characteristics of the earth. It talks about Earth on which we and all living things are living.

Teaching Aids

The following teaching aids are suggested to be used.

- Picture of the Solar System.
- Model of the Solar system.

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

This section is interesting because it deals about what makes us to live on Earth. Why no life is found on other planets but only on Erath should be discussed. Each factor that makes Earth suitable for life should be discussed.

The unique characteristics of the earth as compared to other planets should also be discussed. Exercise 6.6 will help you to sum up all these discussions.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Suggested answer for activities.

To get the answer, for activities 6.1, 6.2, and 6.4 refer the students' textbook.

Activity 6.3 is constructing a model that helps to discuss all planets move elliptically with no one colliding with the other.

project 6.1 is about constructing another model that helps to compare the distance, position and size of each planet.

Arrange a Field trip to visit the Ethiopian Space Science and Technology Institute.

Field trip

- Going on a field trip enhances students critical thinking skills.
- Gives students a chance to think about a topic or theme from a different perspective.
- Field trip gives students the chance to experience new venues.
- Field trips offer opportunities to students that they may not have known existed.
- It exposes them to learning experiences that cannot be duplicated inside the classroom.

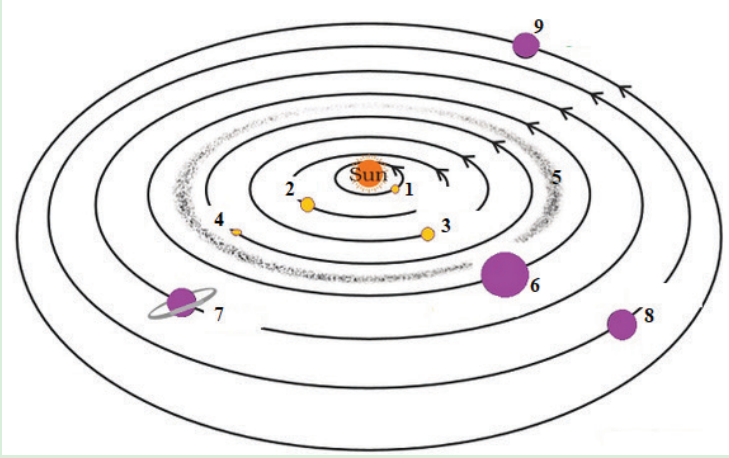
Answer to Exercises

Exercise 6.1:

1. Sun
2. Pluto
3. Comet
4. Mercury
5. Jupiter

Exercise 6.2:

1. The differences between inner and outer planets are
   - The inner planets are the first four planets that are closer to the Sun, and the outer planets are the last four planets that are far from Sun.
   - The inner planets are made of rocks and metal while the outer planets are gaseous.
   - The inner planets has no or few number of moons but the outer planets have large number of moons.
2. The names of planets in the solar system are: Mercury, Mars, Earth, Venus, Jupiter, Saturn, Uranus and Neptune.
3. The position of the planets in the diagram of the solar system shown are:



1. Mercury
2. Venus
3. Earth
4. Mars
5. Asteroids
6. Jupiter
7. Saturn
8. Uranus
9. Neptune

4. Inner planets are denser than outer planets, because inner planets are made of rocks and metals while outer planets are made of gases.
5. Saturn (82) has more moons followed by Jupiter (79).
6. Mercury, because it is the closest planets to the sun.
7. Neptune, because it is the farthest planet from the sun.
8. Jupiter, its period of rotation 9 hours and 50 minutes.

Exercise 6.3

1. The motion of a satellite around Earth is similar to the motion of planets around Sun. It is the gravitational force between the satellite and Earth that keeps the rotation to sustain on its orbit.
2. Satellites are moving around planets while planets are moving around Sun.

Exercise 6.4:

1. The position of each planet in the solar system can be compared using the figure on exercise 6.2, number 3.
2. Earth is the third planet in the solar system. Found between Mars and Venus at a distance of about 150 million kilometer from Sun.
3. The name of all planets outward from the sun are: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.

Exercise 6.5: Answer the following questions based on the above project work.

1. The size of planets is not the same and have no relationship with their position.
2. The smallest planet is Mercury.
3. The largest planet is Jupiter.
4. In order of increasing size of the planets: Mercury, Mars, Venus, Earth, Neptune, Uranus, Saturn and Jupiter.
5. To answer this question refer table 6.1.

Exercise 6.6:

1. The Earth is suitable for life for the following reasons.
   - I. Earth has right amount of liquid water.
   - II. Earth is found at the right distance from the Sun.
   - III. Earth has the right temperature that allows liquid water to exist
   - IV. Earth has the right moon.
   - V. Earth has the right Sun.
   - VI. Earth has the right core.
   - VII. Earth has a huge neighbor, Jupiter.
   - VIII. The Earth's atmosphere is rich in oxygen, Nitrogen, Carbon Dioxide, and other compounds that are essential for life.
   - IX. Earth has an ozone layer.

1. The unique characteristics of Earth are: having liquid water, temperature, atmosphere etc.

Answer for Review Exercise

Part I: Answers to True or false questions.

1. True
2. False
3. True
4. True
5. True

Part II: Answers to multiple choice questions

1. (c) A constellation.
2. (a) Meteors
3. (d) Sun
4. (a) Comets
5. (b) Earth

Part III: Answers to Matching questions

1. Earth(d)
2. Venus (c)
3. Moon (b)
4. Pluto (e)
5. Neptune (a)

Part IV: Answer to Fill in the blank Questions

1. Neptune

2. Mars

3. Satellite

4. Mars and Jupiter

5. Saturn

Part V: Answer to short answer questions.

1. Our solar system consists of the sun, planets, dwarf planets, moons, an asteroid belt, comets, meteors, and other objects. The sun is the center of our solar system; the planets, over 61 moons, the asteroids, comets, meteoroids and other rocks and gas all orbit the Sun. Define a solar system.
2. The families of the solar system include: The Sun, planets, dwarf planets, moons, asteroids, comets, and meteors.
3. The name of the planets in the in order of increasing temperature: Neptune, Uranus Saturn Jupiter Mars, Earth, Mercury and Venus.
4. The eight planets that orbit the sun are (in order from the Sun): Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune.
5. In order of increasing size of planets: Mercury, Mars, Venus, Earth, Neptune, Uranus, Saturn, and Jupiter.

UNIT SEVEN

PHYSICAL PHENOMENA IN THE SURROUNDING

Time allotted to the unit: 22 periods

Learning Outcomes: At the end of this unit, you will be able to:

- Understand sources, dispersion, image formation and purpose of light.
- Know general concept of sound.
- Differentiate simple electric circuit and magnetism.
- Define the term heat.

Contents of the unit

Unit 7: Physical Phenomena In The Surrounding

7.1 Phenomena of Light

7.2 Vision and Imaging

7.3 Sound

7.4 Heat

7.5 Simple circuit

7.6. Magnetism

Unit Overview

This unit deals about the physical phenomena in the surrounding, which include, light, sound, heat, electricity and magnetism.

Under light after defining light as a form of energy, the sources of light, the properties (reflection, refraction and dispersion) and purposes of light will be discussed. Then vision and image formation and identifying transparent, translucent and opaque materials will be discussed.

Under sound after defining sound as a form of energy, the formation of sound, the propagation of sound through solids, liquids and gases will be discussed. The causes of sound pollution, and strategies for reducing the effects of sound pollution on human ear will be discussed. Finally the formation and applications of echo will be discussed.

Under heat after defining heat as a form of energy, the mechanisms of heat transfer (conduction, convection and radiation) will be discussed.

Under simple electric circuit after defining a circuit as a complete path through which an electric current flows, the components of a simple circuit and its construction will be discussed,

Under magnetism after defining magnetism as a branch of physics which studies about the properties of magnets, the different types of magnets and drawing magnetic field lines will be discussed.

Enough number of activities are included so as students will learn by doing hands on activities. The importance of light for vision and image formation will be discussed.

Sound as a form of energy, its production and transmission in solids, liquids and gases will be seen. The causes of sound pollution and strategies to overcome these challenges need to be discussed. Echo as a reflection of sound and its applications will also be discussed.

Definition of heat and the three mechanisms of heat transfer will be discussed.

Students will the construct a simple circuit and list the materials required to make the circuit.

Finally the definition of magnetism and the uses of magnets will be discussed.

7.1 Phenomena of Light

Proposed number of periods: 4 periods

By the end of this section students should be able to:

- list some sources of light;
- describe reflection and refraction;
- explain dispersion of light;
- show colors formed on the other side of the prism.

Contents of the sub unit

- Phenomena of light (source and properties)

Suggested teaching methods

- Discussion
- Explanation
- Question and answer

Forward Planning

Ask the students to complete the questions and the projects given at the end of the chapter.

This section deals about light, the source of light, reflection of light, refraction of light and dispersion of light. These topics can be done using experiments or activities. The lessons should be students' centered, that is students' should engage in the teaching learning process. All of the concepts in reflection, refraction and dispersion of light can be checked by doing them practically.

The classification of transparent, translucent and opaque object should be done practically in the class using activity 7.4 and 7.5. Image formation is another interesting topic which can be shown practically. Image formation by medical instruments like, x-ray, ultrasound and MRI should be as an application.

Sound as another form of energy should be raised. The difference in the speed of sound while traveling through solids, liquids and gases should be discussed. In addition the fact that sound could not travel through vacuum need to be proved experimentally.

Sound pollution is an issue to be discussed in detail, because it is one of the problems of our city, Addis Ababa. Not only the problem but also the mechanisms of removing the problem should be discussed. If possible inviting professionals on sound pollution is advisable.

Teaching Aids

The following teaching aids are suggested to be used.

- Picture of the solar system.
- Model of the solar system

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

Start by asking questions like, what is light? Which light is called white light? The properties of light and image formation.

Based on the response of the students prepare a plan for your lessons.

This topic can be started by putting off all the lights and closing the windows of the classroom. Now, teacher will light a torch and ask students what do they observe?

Luminous and non-luminous objects: Luminous objects are objects which give of their own light. non-luminous objects do not emit light but reflects that falls on them. Students should be able to explain the meaning of these two terms with example.

Reflection: If you can bring a plane mirror to the class and show practically the reflection of light from different surfaces will help a lot in clarifying the concept of reflection. Students must have observed such phenomenon in on their daily lives, so the job of the teacher is to link their day-to-day observation to their understanding. Activity 7.3 will help you for this purpose.

Explain to the students that we are able to see objects, when light rays from the source fall on these objects and reflects to our eye.

Explain regular reflection with the help of mirror and diffused reflection with the help of examples. For example, we are able to see things inside the room even though the sun rays do not reach directly inside the room.

Explain to the students the lateral inversion using demonstration. Tell them to stand in front of a plane mirror. Ask them to lift their right hand and note what happens? They observe that their image will show left hand when they raise their right hand. When they lift the left hand their image shows their right hand.

Explain to the students about the characteristics of refraction. Refraction takes place when light travels from one medium to another medium of different density. The cause of refraction is the fact that the speed of light changes when the medium changes.

Explain to the students that the sunlight is referred to as white light. It consists of seven colors known as VIBGYOR (Violet, Indigo, Blue, Green, Yellow, Orange and Red).

Mirror: Tell students that mirrors are highly polished reflecting surface. Ask students what do they observe when they see themselves in the mirror. Tell students about the types of images formed by the plane mirror.

Prism: Explain the concept of prism with the help of a rainbow. Which depend on the concept of dispersion of light.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

7.2 Vision and Imaging

Proposed number of periods: 3 periods

By the end of this section students should be able to:

- determine the purpose of light;
- classify materials as transparent, translucent and opaque;
- demonstrate how image is formed.

Contents of the sub unit

- Vision and imaging (transparent, translucent and opaque)

Suggested teaching methods

- Discussion
- Explanation
- Question and answer
- Simulations and Animation
- Field-trip

Forward Planning

This section deals about the use of light for vision and image formation. The characteristics of image formed by a plane mirror should be discussed. The lateral inversion property of image formed by a plane mirror could be demonstrated in the class. The difference between transparent, translucent and opaque objects should be seen practically, using activity 7.13.

Students are already familiar with the terms transparent, translucent and opaque objects. They can also give examples of such objects. This topic can thus be covered as a student guided class where some students can explain the topic to other students.

Teaching Aids

The following teaching aids are suggested to be used.

- Torch light.
- Mirror
- Translucent, Transparent and opaque materials

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.
- Demonstration

Subject matter presentation (Teaching Note)

Start by asking the question, what is the purpose of light? and how is image formed?

The purpose of light is for vision, to see our surrounding. Explain image formation by medical equipment, human eye and plane mirror.

Depending on how much light will pass through materials, they will be grouped into transparent, translucent and opaque. Transparent materials are those light could pass easily. Translucent materials are those light passes through them partially. Opaque materials are those materials through which light could not pass. Activity 7.13 helps you to differentiate these materials experimentally.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit exercises as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

7.3 Sound

Proposed number of periods: 3 periods

After completing this section learners should be able to:

- define sound as a form of energy
- explain how sound is formed
- demonstrate the formation of sound
- identify material medium for sound propagation.
- prioritize sound propagation in solid, liquid and gases
- explain the cause of sound pollution
- identify hearing level for different sound
- list strategies of sound pollution
- define echo and demonstrate its application

Forward Planning

Ask the students to complete the questions and the projects given in their textbook. Sound is a form of energy which students already know by using it. It should be mentioned that any source of sound is always vibrating. This vibration of the particle of the medium could be explained using Activity 7.11 and 7.12.

The comparison of the propagation of sound through solids, liquids and gases should be done practically in the class using Activities 7.15 and 7.16

The importance of medium in the propagation of sound should then be discussed. After defining sound pollution, discuss its causes, effects and the measures to be taken to control sound pollution.

Teaching Aids

The following teaching aids are suggested to be used.

- Table or desk
- water
- cup
- Field-trip

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

Ask the students if they are aware about how sound is produced? How are they able to hear the sound?

Explain to the students that we hear different types of sounds from our surroundings. Discuss the important role sound plays in our day to day lives.

Sound Requires a Medium to Travel

Explain to the student that sound travels more quickly through solids than through liquids and gases because the molecules of a solid are closer together and, therefore, can transmit the vibrations (energy) faster.

The speed of sound is maximum in solids, lesser in liquids and least in gases. Note also that sound could not travel through vacuum.

Tell for the students how our ear responds to a disturbance. The importance of the shape of our ear for hearing should also be mentioned.

Discuss with the students about the difference between noise and sound. The meaning of sound pollution, the effects of sound pollution and measure to be taken to control sound pollution should be discussed.

Echo

Explain to the students that when you visit the hills and mountains, you must have experienced echo. When you shout loudly standing on a hill, you hear it back in some time later. It is simply the reflection of sound from the hill or a tall building at a distance.

Explain to the students that when you keep your hand on the skin of a drum, you will feel a vibration. Therefore, sound is produced due to vibration, which can be heard.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

7. 4 Heat

Proposed number of periods: 4 periods

After completing this section learners should be able to:

- define the term heat;
- explain mechanism of heat transfer;
- classify materials as good conductors of heat and poor conductors of heat (insulators).

Suggested teaching methods

- Discussion
- Explanation
- Question and answer

Forward Planning

This section deals about heat. After defining heat as a form of energy discuss the three mechanisms of heat transfer: conduction, convection and radiation. Activities 7.20 and 7.21 will help you to discuss in detail how heat is transferred through solids by conduction and through liquids and gases by convection.

Finally discuss the difference between conductors and insulators. The importance of insulators for insulation purpose should be discussed by relating to our daily life experiences.

Teaching Aids

The following teaching aids are suggested to be used.

- Dish,
- Water,
- Table or desk
- metal stick
- dye
- charcoal

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

To make the class interactive, you can do Activity 7.18 in the school. Bring a cup of cold and hot water to the class. Let students touch them one by one. Then mix the cold and hot water on another container and ask them what they felt after touching? Now, discuss that the hotter body loses energy. Ask them where does this energy go? Those who touch the colder water may say we took it. Then conclude that this form of energy which is transferred from a body at a higher to a body at a lower temperature is known as heat.

Heat: Explain to students how heat is transferred from one object to another due to difference in their temperatures.

Conduction: Explain to students that conduction is just like passing of a book from one child to another. This can very well be explained by Activity 7.19.

Convection: Convection is a means heat transfer through materials whose density changes with change in temperature. That is it is a means of heat transfer through liquids and gases. This concept can be explained very well Using Activity 7.20.

Radiation: Radiation is a means of heat transfer through vacuum, empty space. Which means it is a wave. Explain to students that when you stand under the sun or near a fi re, you feel warmth, this is due to radiation. Activity 7.21 and activity 7.22 will help you to better understand convection. It is just heat transfer in a boiling water. When the burning charcoal heated the nearby air molecules they get expanded. As a result the colder and denser air will take their place. This air again will expand after gaining heat from the charcoal and forced to move away from the charcoal. This process will continue and the whole air in the room will be heated.

Conductors are materials that conduct heat energy through them whereas insulators are materials that do not conduct heat through them. Use Activity 7.23 to differentiate easily conductors and insulators in the class. Discuss the different uses of insulators for the purpose of insulation .

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

7. 5 Simple Circuit

Proposed number of periods: 4 periods

After completing this section learners should be able to:

- list all material used to construct simple circuit.
- construct simple circuit.

Suggested teaching methods

- Discussion
- Explanation
- Question and answer
- Demonstration
- Simple experiment

Forward Planning

This section deals about simple circuit. List all the components of a simple circuit and explain their use. Explain for the students the two ways of making circuit diagrams: using the figure of real object and using their symbols.

Teaching Aids

The following teaching aids are suggested to be used.

- Source of electricity,
- switch,
- conductor
- bulb

Subject matter presentation (Teaching Note)

Electric cell: A cell is the source of electricity which makes electrons inside the conductor to flow so that the bulb will give of light. You can bring a dry cell to the class and show for the students.

Electric bulb is an electrical material which gives off light when electricity flows through it.

Electric circuit: An electric circuit is a complete path through which electricity flows. When it is open the bulb will not give light but when it is closed the bulb will give light. After explaining this concept arrange all the components of simple circuit and let students construct a simple circuit themselves under your supervision. This can be taken as a formative assessment activity. This will help develop psychomotor skills among the students. Various components of an electric circuit should be taught in the class. The students shall also be told about the difference between an open and a closed electric circuit.

Electric switch: A switch is a device used to close or open an electric circuit. You can show how it works in an electrical circuit. In constructing a simple circuit tell students to use the steps given in Project 7.5.

Safe use of electricity: Since this is an experiment-based chapter where students work with electricity, precautions related to handling the electrical appliances should be taken and instruction to safely used the electricity should be clearly given to the students.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

7. 6 Magnetism

Proposed number of periods: 3 periods

After completing this section learners should be able to:

- do simple experiment and construct magnetic lines of force;
- explain the use of magnet.

Suggested teaching methods

- Discussion
- Explanation
- Question and answer
- Demonstration
- Animations and Simulations
- Simple experiment

Forward Planning

This section deals about magnetism. First define the term magnetism. Then discuss the characteristics of both natural and artificial magnets. The concept of magnetic field should be clearly discussed. Activity 7.25, and activity 7.26 plotting magnetic field lines should be done in the class. It is interesting and makes the concept more clear.

Teaching Aids

The following teaching aids are suggested to be used.

- magnet
- iron filings,
- compass
- paper

Suggested teaching methods;

- Discussion
- Explanation (lecture) and
- Questioning and answering.

Subject matter presentation (Teaching Note)

To make the class interesting, the teacher can start the topic by asking questions like: What are magnets? Where are they used in our daily life?

Magnets: Magnetic and non-magnetic materials and types of magnets should be discussed with the students. Students should be asked to complete Activity 7.28 and 7.29 and discuss the activity in the class. All the properties of magnetic field lines should be discussed.

Poles of a magnet: Different shapes of artificial magnets can be used to explain the poles of a magnet and many other properties related to magnetic poles, like; a magnet is dipolar, magnetism is maximum at poles and property of attraction and repulsion. Using magnets of different shape: Circular magnet, horse shoe shaped magnet, bar magnets, cylindrical magnets etc. it can be shown to the students by using the attraction of a magnet towards iron fillings as the activity.

Students can also make their own magnet. You can give them as a project.

Magnetic compass: A magnetic compass should be shown to the students and its working and construction should be taught. A temporary magnetic compass can also be prepared in the class.

Uses of magnets: Students should be explained that magnets are used in many fields and should be stored properly so that their magnetism is retained for a longer period.

Stabilization:

- Summarize the lesson by giving them short notes. Ask them to do selected questions from the end of unit questions as class work and home works and further reading assignment.
- Give them feedbacks to their class work and home work activities.
- Support students who failed to answer these questions.

Suggested answer for the activities

Activity 7.1: This activity is introduced for the reason that students themselves define what light is. Light is a form of energy that enables us to see objects surrounding us.

Activity 7.2: Even though there are more than three properties of light, pay attention to reflection, refraction and dispersion.

Activity 7.3: Whenever we see non-luminous objects there is reflection. You can see your friends, the black board, your book etc. due to reflection of sun light from these objects.

Activity 7.4: Put a pen or pencil on a glass partially filled with water. Discuss in group about your observation.

Activity 7.5: The hidden coin experiment is interesting and fun. Tell students to follow the steps given in the textbook and enjoy with the fun.

Activity 7.6: this activity and the next activity 7.7 are also interesting. Students will enjoy by creating a rainbow in the class or at home. If a prism is not available in your school you can do only activity 7.7.

Activity 7.8: Refraction occurs when light falls on a prism. The wavelength and frequency of these deviated colors is different, they deviate differently at different angles due to the velocity difference on the prism. The color red therefore deviates the least since it has maximum wavelength and color violet deviates the most since it has the least wavelength.

Activity 7.9: The main purpose of light is vision, looking the surrounding.

Activity 7.10: To have two requirements should be fulfilled. One there should be light and two eye should be open and function properly.

Activity 7.11: By just looking their raised left hand students themselves will see that in the mirror it is the right hand that is raised. The lateral inversion of image by plane mirror is demonstrated.

Activity 7.12: The remaining properties of image formed by plane mirror: the size of the image is the same as that of the object and the distance of the object from the mirror is equal to the distance of the image from the mirror is demonstrated by taking measurement and based on observation.

Activity 7.13: By just looking what students see after light is made to pass through these objects they should be able to classify as transparent, translucent and opaque.

Activity 7.14: This activity also demonstrates the vibration of a source of sound. When touching the skin of the drum students should feel the vibration.

Activity 7.15: and Activity 7.16: by doing these two simple students will be able to conclude that sound can travel through solids and liquids.

Activity 7.17: If airtight jar is available in your school, this activity will demonstrate that sound needs a medium. It couldn't move through vacuum.

Activity 7.18: When students put their hands on the mixed water (cold +hot) they should feel hotter on the hand which was in the cold water and they feel colder with the hand which was in the hot water. This means the hot water loses heat and the cold water gains heat. Based on this observation assist students to conclude that it is this energy that is known as heat.

Activity 7.19: One end of the metal stick is inside the hot water, students hold the other end. After some time they feel the stick is warmed. The heat energy of the hot water passes through the stick by successive molecular collision.

Activity 7.20: In this activity student will see how the convection current takes place. Especially if you could get potassium permanganate that will be better otherwise use dye, so that students could clearly see the convection current.

Activity: 7.21: Heat from the Sun reaches earth by radiation. It is because there is an empty space (vacuum) between Sun and Earth indicating that it can't be conduction and convection.

Activity 7.22: Heating a room with a heater contains both convection and radiation. The convection current occurs vertically. We also feel hot if we stand sideways. This is radiation.

Activity 7.23: Using this simple activity, students can easily differentiate conductors from insulators. On touching the end of the object, if they feel hot soon that is a conductor otherwise it is an insulator.

Activity 7.24: Metallic pans are covered with an insulator so that heat won't be transferred to the person's hand. He or she is safe from burning.

Project 7.3: Clothes like Gabi which are made of cotton are good insulators. They protect us from the cold.

Project 7.4: Assist students to strictly follow the steps. They can easily make the circuit.

Activity 7.25: You need to bring iron filings if not available in your school. You can get from metal workshops. Then the activity is simple, but what is seen is interesting. Students see what the field lines look like practically.

Activity 7.26: This activity is the same as activity 7.28, except that instead of iron filings a compass needle is used. A compass needle is simply a small suspended magnet.

Project 7.5: This is a discussion between students to contribute on idea on the uses of magnets.

Answer to the Review Exercises

Exercise 7.1:

1. The main source of light for Earth is the Sun.
2. No, the moon is not a source of light. It just reflects light from the Sun.
3. Natural sources of light: the Sun, stars, thunderstorm
4. Artificial sources of light: bulbs, lamps, candle, burning wood.

Exercise 7.2:

Part I:

1. False
2. True
3. True
4. False

Part II. Choose the correct answer among the given

1. B	4.A	7. B
2. C	5. B	8.C
3. C	6.C	9.A

Exercise 7.3:

The main purpose of light is for vision, looking your surroundings.

The reason for writing AMBULANCE in that way is because a car in front of the AMBULANCE will see it with a mirror reversed. If you write the corrected you will see the reversed. If you write the reversed you will see the correct one.

The characteristics of the image formed by a plane mirror are: virtual, erect, laterally inverted, the same size as the object and the same distance behind the mirror as the object is in front of it.

Exercise 7.4:

Part I: Choose the correct answer

(C) Virtual, upright and the same size as object

(B) opaque materials

(A) transparent materials

(D) frozen glass

Part II:

In order: energy, opaque, transparent, translucent.

Part III: Give a short answer

Transparent: materials that transmit light.

Translucent: materials that transmit light partially.

Opaque: Materials that do not allow light to pass through them.

Transparent: window glass, water and air.

Translucent: Oiled paper and waxed paper.

Opaque: Metal, stone and book.

Exercise: 7.5: Yes, when we speak, our tongue and lips are vibrating.

Exercise 7.7

Part I: Choose the correct answer

1. (D) Vibrating objects only.
2. (C) energy
3. (D) vacuum
4. (B) 80 dB

Part II: Fill in the blank spaces with appropriate word.

1. Noise
2. Solids
3. Sound pollution
4. medium
5. vibration

Part III. For the following questions, give a short answer

1. When it is vibrating.
2. Sound can travel through solids, liquids and gases.
3. Reflection of echo is applied in hearing aids, sound board and streetscape.

Exercise 7.8:

Conduction: when we touch any hot objects.

Convection: heating a room with a heater.

Radiation: radiation from the Sun,

Exercise 7.9:

Part I: Choose the correct answer.

1. (D) heat
2. (B) insulator
3. (C) conduction
4. (B) convection

Part II: Give a short answer.

1. Heat is a form of energy that flows from a body at a higher to a body at a lower temperature.
2. Conduction: a mechanism of heat transfer by touching and molecular collision. It is used fir solids.
   Convection: a mechanism of heat transfer by change in the density of liquids and gases.
   Radiation: a mechanism of heat transfer through vacuum, empty space.
3. Conductors: all metals
   Insulators: wood, plastic, mica, brick, etc.

Exercise 7.10:

Part I:

1. True
2. False
3. True

Part II: Choose the correct answer.

1. (B) Open
2. (C) switch
3. (A) Circuit
4. (B) battery
5. (A) material that current can pass through easily.

Exercise 7.11: At the poles.

Part I. Write TRUE fir correct and FALSE fir incorrect statements

1. True
2. True
3. False.
4. False

Part II: Choose the correct answer

1.(C) lodestone

2. (C) magnetic field

3. (B) north – south direction.

Review Exercise

Part I:

1. True
2. False
3. True
4. False
5. True
6. False
7. True
8. False

Part II:

1. (A) Red, Orange, Yellow, Green, Blue, Violet
2. (A) reflection of light
3. (D) solid > liquid > gas
4. (B) circuit (C) switch

Part III: Fill the blank spaces with an appropriate word.

1. Luminous
2. retina
3. energy
4. radiation
5. conductors
6. poles

Part IV: Give a short answer.

1. Reflection: the turning back of a wave in reaching to a boundary through which it can't move.
   Refraction: the change in direction of a wave, (bending) in reaching to a boundary through which it can't move, it can't move.
2. The purpose of light is for vision.
3. The causes of sound pollution are: sounds of vehicles, explosions, machines, loudspeakers etc.
4. The materials needed to construct a simple circuit are: a cell or battery, bulb, switch and a conductor.
5. Magnetism is the branch of physics that studies about the characteristics of magnets.

Syllabus
Subject: General Science
Grade: 8

Unit One: Basics of Scientific Investigation(17 periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Identify the basic and derived units of measurements, give examples of measurement from everyday experience,.
- Measure length, area, temperature volume and mass (including mass and volume of liquids and solids but not of gases) using appropriate instruments (measuring tape, meter rule, thermometer digital calipers, measuring cylinder, electronic balance) and methods
- Apply the principles of measurement in the solution of everyday problems.
- Ask questions about objects and events in the local environment and develop plans to investigate those questions.
- Appreciate the importance of scientific methods.
- work collaboratively to carry out science-related activities and communicate ideas, procedures, and results.
- Access information, using a variety of sources. Examples: libraries, magazines, community resource people, outdoor experiences, Internet.
- Exhibits values of honesty, objectivity, cooperation, freedom from fear and prejudices.

Competencies	Contents	Learning Strategies	Assessment
• Identify the basic and derived units of measurements • Explain the concept of measuring physical quantities • Measure length, area, volume ,mass, and temperature using appropriate instruments.	1.1. **Scientific Measurements** (7 periods) • Base and Derived Unit of Measurement • Measurement of Physical Quantities	• Students could be asked to suggest a simple working definition of the term physical quantity‖. Share and discuss their definitions with class. (A physical quantity is a measurable characteristic of anything.) • Students should appreciate that, science is about taking measurements and making observations, and using them to come to conclusions. • Science is about looking for patterns in the way materials behave. • The learner may be provided opportunities in pairs/groups/ individually and encouraged to: – discuss the importance of scientific measurements to the study of science – compare base and derived units of measurement using specific physical quantities	Observation – collaborative and independent work Observe students during activities Performance assessment - presentation Report

		- demonstrate how to measure mass, length, time, temperature and volume. • A circus of experiments may be used to introduce this by measuring the temperature, mass, and volumes of different colored liquids (water/food dye) estimate length, mass and volume	
• Describe the components of a scientific investigation • Demonstrate ability to work effectively and respectfully with others in performing fair testing. • Practice scientific investigation procedures using appropriate contents to their age levels	**1.2. Doing Scientific Investigation (10 periods)** • Scientific methods • Semi-guided investigations	• Students should be aware that, a scientific investigation generally involves some or all of the following steps: ask a question, form a hypothesis, gather and analyze evidence, decide whether the evidence supports the hypothesis, draw conclusions, and communicate results. • Students should know that scientific investigations must be guided by ethical rules. Opportunity to reinforce ethical values. • The learner may be provided opportunities in pairs/ groups/ individually and encouraged to: -conduct simple investigations to seek answers to queries such as: (a) Does a coiled nail act like a magnet? (b) Is air necessary for burning? (c) (c) How do plants store their food in their leaf? (d) Will using or not using fertilizer help a plant grow better?	Research Output Performance assessment: Tasks: Role play, reflection etc. Activity: Application of Scientific Method Performance assessment; Role play write a report in groups or independently

		(e) What are the causes of molding bread/ injera? etc. – record the observations during these activity, experiments, surveys, field trips, etc. – analyze recorded data, interpret results and draw inference/ make generalizations and share findings with peers and adults formulate, with guidance, specific questions that lead to investigations. Students could be asked to debate on • The student could solve the issue of environmental problems in their school compound and its surroundings. For example • How garbage in school compound can be disposed without affect the environment?	

Unit Two: The composition of Matter (11 Periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Narrate the historical development of the atomic nature of substances
- Appreciate that atoms are the building blocks which make up all substances
- Demonstrate understanding of the idea that the identity of a substance is determined by its atomic structure
- Describe an atom as an entity that is electrically neutral and is made up of a positively charged nucleus protons and neutrons) with negatively charged electrons moving around the nucleus.
- Differentiate molecules of elements from molecules of compounds.
- Demonstrate scientific inquiry skills along this unit: communicating, asking questions, drawing conclusions, making model, applying concepts

Competency	Content	Learning Strategies	Assessment
• Give a short history of the concept of the atom. • Compare and contrast the continuity and discreteness (discontinuity) theory of matter. • Compare earlier conceptions of the structure of matter with their conceptions.	**2.1 Early thinking about the composition of matter (3 periods)**	• This unit can begin with a What I Know-Want to Know-Learned (KW-L) or brainstorming activity centered on the topic of matter. Questions such as –What is matter?‖ –What do you think matter is made up of will allow for an assessment of This students' prior understanding and knowledge of matter. • Students should give a short history of the concept of matter	• Oral questions • Observe students while they doing activities

		and appreciate that the particulate nature of matter was discussed by the ancient Greeks. They argued that if a substance was divided in half enough times, there would come a time when only a single particle remained. This was not supported by any practical work. • In group, students could research the idea of a fundamental building block proposed by the ancient Greeks and the meaning of the word _atom‖. • Demonstrate to students the thinking behind Democritus's idea of the atom. As students watch, cut an aluminum foil in half. Then cut one of the halves in half. Continue cutting the pieces in half until they are too small to cut into smaller pieces. Relate the demonstration to Democritus's idea of –uncuttable‖ pieces, or –atomos.‖ • He proposed that matter is made up of tiny particles that cannot be reduced to smaller pieces • A box of paper clips can also be used to illustrate the concept of an atom. The paper clips can be spread out and their number divided in half a number of times. Eventually we arrive at one paper clip which is the equivalent of an atom. What we have is still recognizable as a paper clip and still does the job of a paper clip. If we try to divide this further what	• Performance assessment-Report /presentation • Observation – collaborative and independent work

		we end up with is two pieces of wire which no longer resemble a paper clip and are no longer able to do the job of a paper clip. In terms of atoms, once we break up an atom it no longer has the properties of the substance. • Have students perform a debate involving the Aristotle continuum idea of matter and Democritus discrete idea of matter. One student would defend the Aristotle continuum idea, while the other would defend the Democritus idea. • From the discussion in this lesson Students should recognize that science-based ideas are continually being tested, modified and improved as new knowledge and explanations supersede existing knowledge and explanations.	• Performance assessment- Debate
• Describe the structure of an atom as a nucleus containing protons and neutrons, surrounded by electrons in shells (energy levels)	2.2 Inside of an atom • Parts of an atom (5 periods)	• Students should know the two parts of atom – Nucleus and Electron Shell	• Oral questions

• State the relative charge and approximate relative mass of a proton, a neutron and an electron. • Draw hydrogen atoms, including the location of the protons and electrons, with respect to the nucleus.	• The Subatomic Particles – Relative mass, the charge and location of subatomic particles	• Students should be aware of the relative mass, charge and location of sub-atomic particles within an atom. This could be given as a table. • Start a simple sketch of a hydrogen atom on the board by drawing a small circle labelled –nucleus.‖ Add a smaller circle labelled –proton‖ inside the nucleus. Call on a student to come to the board and add the electron and its orbit to the sketch. (The student is likely to draw a circle around the nucleus and add a symbol such as a dot for the electron.) • Point out that this is how electrons are usually represented but it's misleading. Explain that if the nucleus were the size of the nucleus in the sketch, then the electron orbit would actually be about 800 meters away with nothing but empty space in between. • Stress the importance of using models to study atoms because they are so small. Then have students create model of hydrogen using local materials.	• Observe students during activities • Observation – collaborative and independent work • Observe students during activities • Oral questions • Quiz • Model
• Differentiate between mass number and atomic number.	• Atomic Number and Mass Number	• Students could use a Periodic Table to look up the atomic numbers and mass numbers (approximately equal to atomic mass) of common elements from both their names and their	• Observe students during activities • Written assessment

		atomicsymbols. This will provide a useful way of revising work done in Grade 7 Unit 3. Do not attempt to explain the structure of Periodic Table at this stage	
• Determine the number of protons, neutrons, and electrons in an atom.	• Determination of the electrons, protons and neutrons	• Students should be aware that in an atom the number of: - protons is equal to its atomic number. - electrons is equal to the number of protons. - The number neutrons is the difference between the mass number and the atomic number. • Students should deduce the numbers of particles in atoms of different elements from the atomic number and mass number. Students can use charts to arrange the atomic number, mass number, number of protons, neutrons, and electrons of the first 10 elements. • Students should recognize that an element is identified by its number of protons in the nucleus/ atomic number.	• Written assessment • Oral Questions
• Define molecules • Give examples of monatomic, diatomic and polyatomic molecules. • Use models or particles model diagram to represent molecules of elements and compounds.	**2.3 Molecules** (3 periods) • Molecules of elements	• Students should be familiar with the term molecule as two or more atoms of the same element or different elements combined together. chemically from their work in grade 7 unit 3	• Written assessments • Oral Questions

• state the numbers and types of atoms, given the chemical symbol of an element or the chemical formula of a compound,.	• Molecules of Compounds	• Students could be asked to give examples of molecule of elements. – Monoatomic - He, Ne, Ar – Diatomic - H_2 , O_2, F_2 , Cl_2 , Br_2, I_2 – Polyatomic - O_3, P_4, S_8 Students should be given available resources (polystyrene balls; play dough etc) to make and use models or use particles model diagrams to represent simple molecules of elements and compounds such as O_2, N_2,, CO_2, H_2O , ,NH_3 etc.	• Models

Unit Three: Classification of Compounds (21 Periods)

Learning Outcomes:

- Explain the classification of compounds into organic and inorganic
- Write the formulas and names the first eight alkanes, alkenes alkynes and list the uses of some important common organic compounds
- Classify oxides into different groups and give examples of each group
- Define the terms acid, base, salt and indicator
- give examples of some common household acids, bases, salts
- Develop skills in identifying acidic, basic and neutral solutions
- Explain the physical and chemical properties of acids and bases, including their effects on indicators, metals and carbonate salts.
- Define, and apply the concept of neutralization
- Explain the safety precautions while working with acids and bases
- Demonstrate scientific inquiry skills along this unit: Observing, classifying, comparing and contrasting, communicating, asking questions, designing experiment, drawing conclusion, applying concepts and problem solving

Competencies Contents	Contents	Learning Strategies	Assessment
• Define organic compounds as carbon containing compounds and give examples	3.1 Introduction (2 periods) 3.2 • Organic compounds	• Students should be aware that chemical compounds can be broadly divided into two groups called organic compounds and inorganic compounds and define inorganic compounds and inorganic compounds • Students could research and present to the class the historic origins of the terms organic and inorganic and in particular the relationship between organic chemicals and living things. • Students should be made aware that all organic compounds contain carbon and hydrogen, along with other possible elements such as oxygen, but some compounds containing carbon (for example, $CaCO_3$, CO_2) are classed as inorganic. • Students should be aware of the modern definition of organic compounds as compounds containing carbon in their molecules excluding carbonates, hydrogen carbonates, carbon monoxide and carbon dioxide which are inorganic.	• Oral Questions • Performance assessment Presentation • Written and oral Questions
• Define inorganic compounds as compounds of elements other than carbon.	• Inorganic compounds	• Students should be aware of the modern definition of inorganic compounds as compounds of elements other than carbon • Students could be given the formula of some common compounds and asked to identify which group they belong to. Some examples are: - $C_{12}H_{22}O_{11}$ – NaCl – CaO – C_2H_6O	• Quiz

• Define hydrocarbons and mention at least one source of hydrocarbons • Write the general formula of alkanes, alkenes and alkynes. • Write the specific chemical formulas of the first eight members of alkanes, alkenes and alkynes. • Describe a homologous series and its general characteristics. .	**3.2 Organic Compounds** **(7 periods)** • Hydrocarbons and its sources) • Alkanes, Alkenes and Alkynes - Formula	• Students should understand that the term hydrocarbon is used to describe organic chemicals that contain hydrogen and carbon only. • Students should research source of hydrocarbons thatis found in Ethiopia and report to the class. • Students should be made aware of the three groups of hydrocarbons: alkanes, alkenes and alkynes. They should recognize that all members of a group can be represented by a general formula. (Do not attempt to explain the structure formula at this stage) • Alkanes—can be expressed by the general formula C_nH_{2n+2},where n is the number of carbon atoms. • Alkenes—have the general formula C_nH_{2n}. • Alkynes—have the general formula CnH_{2n-2}. • Students could use the general formula to generate the chemical formulas of the first eight alkanes in the series. For example: n=1, CH_4, n=2, C_2H_6 etc. • Students should use the general formula to write the actual formulas of alkanes, alkenes and alkynes for different values of n. • Students should be made aware of that organic compounds are classified into groups – called homologous series which can be represented by general formula. They should be asked to find the difference in the number of carbon and hydrogen atoms in the formulas of consecutive members of alkane series. This activity could be extended to alkanes and alkenes series. From these activities students should be able to infer that the difference inthe number carbon and ahydrogen atoms between the successive members of any homologous series is the same (i.e. – CH_2 -).	
• Name the first eight members of alkanes, alkenes and alkynes	• Nomenclature	• Students should understand that the name of a hydrocarbon is derived from the number of carbon atoms present (prefix) and the ending it contains (suffix). • Students should be given the prefixes used for	

		hydrocarbons containing up to 8 carbon atoms:1 meth, 2 eth, 3 prop, 4 but, 5 pent, 6 hex. 7 hept , 8 oct, • Students should be given the suffixes for the three groups of hydrocarbons: alkanes – ane, alkenes –ene, alkynes – yne. • Students should use the suffix _ane' to generate the names of the first eight alkanese.g. meth + ane = methane, eth + ane= ethane, prop + ane propane etc. • Students could be asked to construct the name of a compound from information given e.g. an alkene containing 4 carbon atoms is butene. They could also be asked to deduce the molecular formula of a hydrocarbon from its name e.g. butane is an alkane containing 4 carbon atoms.	
• Identify some common uses of organic compounds	• Uses of common organic compounds	• Students should be able to identify important uses of common organic compounds. These could include: – Methane – fuel gas – Propane and butane – bottled gas (buta gas) – Ethyne – at high temperature for cutting and welding – Ethanol – in alcoholic drinks – Ethanoic acid – in vinegar – Formalin - preservation	

• State that inorganic compounds are classified into oxides, acids, bases and salts	**3.3 Inorganic Compounds (8 periods)**	• Students should be aware that, just as with organic compounds, inorganic compounds can be classified into groups according to their composition and their properties. These include: – Oxides – Acids – Bases – Salts	• Oral or written questions
• Classify oxides into metallic and non-metallic. • Describe the properties of acidic oxides and basic oxides.	• Oxides	• Student could use the concept of compounds to introduce oxides as compounds of an element with oxygen and discuss some common examples of oxides e.g. water (hydrogen oxide), carbon dioxide, rust (iron(III) oxide), lime (calcium oxides)	

• Predict the nature of common oxides.	- Types of oxides – Properties of oxides	• Students should be made aware that oxides can be classified as follows: - Metallic oxides - binary compounds containing only metals and oxygen. e.g. Na_2O, MgO • Non-metallic oxides - binary compounds containing nonmetals and oxygen. e.g. CO_2, , SO_3, H_2O • Basic oxides react with acids – most oxides of metals - Acidic oxides react with bases – most oxides of non-metals • Students should know that most metals form oxides which exhibit basic properties and only some of them dissolve in water to give alkaline solutions and most non-metals form oxides which exhibit acidic properties and dissolve in water to give acidic solutions.	
		• Students could be asked to predict the nature of the oxides formed by some metals, such as sodium, potassium and calcium, and some non-metals such as carbon and phosphorus.	

• Prepare sulphur dioxide in the laboratory by burning sulphur in air and use moist blue litmus paper to test its acidic nature.		• Students should prepare sulphur dioxide, an acidic oxide, by burning sulphur in air in a gas jar. The resulting gas should be shaken with a small amount of water and litmus solution or blue litmus paper should be added to demonstrate that the resulting solution is acidic.	Performance assessment using rubric /checklist to assess process skills and concepts
• Prepare magnesium oxide in the laboratory by burning magnesium ribbon in air and use red litmus paper to test its basicity in water solution.		• Students should prepare magnesium oxide, a basic oxide, by burning magnesium in air in a gas jar. The resulting powder should be shaken with a small amount of water and litmus solution or red litmus paper should be added to demonstrate that the resulting solution is alkaline (basic).	Performance assessment using rubric /checklist to assess process skills, core skills

			Quiz
• Relate acidic .properties to the presence of hydrogen ions and basic properties to the presence of hydroxide ions.	• Acids and Bases	• Students should appreciate that acids are a group of substances that all release hydrogen ions, H+, when in aqueous solution and they have sour taste. • By contrast, students should understand that bases are a group of substances that all react with acids by neutralizing them to form salts. They should also know that bases which are soluble in water are called alkalis. Alkalis release hydroxide ions, OH^-, when in aqueous solution and have better taste. • Students should give list of some acidic substances in their daily life. These could include lemon juice, vinegar, sour talla and milk etc. • Alternatively In groups, students could be asked to bring labels and samples of substances from the home that they think are acids and alkalis. Sort the samples as acids and alkalis based on the physical properties and the information presented on the labels. Report on their findings (using simple scientific language, drawings, labelled diagrams, bar charts or tables).	

			Quiz
• Name and write formulas for some common acids (HCl, HNO_3, H_2SO_4) and bases (NaOH, KOH, NH_4OH), using the periodic table, a list of ions, and rules for naming acids.	• Naming and writing formula of acids and Bases	• Students should be able to write the formulas of some common acids (for example, HCl [hydrochloric acid] • H_2SO_4 [sulphuric acid], HNO_3 [nitric acid]), bases (for example, NaOH, $Ca(OH)_2$). They should also be introduced to the rules for writing and naming common acids.	
• Describe how indicators can be used to classify solutions as acidic or basic. • Define and draw the pH scale • Use the pH scale to classify solutions as neutral, acidic or basic	• Acid- base indicators and PH • Acid base indicators	• Before they explore the properties of acids and bases students should be made familiar with acid-base indicators. These could include: • litmus • phenolphthalein • methyl orange • Students should define PH as the measure of acidity or alkalinity of a solution. • Students should be aware that the PH scale ranges from 0 – 14 and pH= 7 is neutral, PH<7 is acidic and pH> 0 is basic	

	• The PH	• Students should draw and label the pH scale • Students could be given pH of solutions and asked to classify them as neutral, acidic or basic solutions .	
• Investigate properties of bases/alkalis experimentally	• Investigating properties of acids and bases	• Students should investigate the properties of acids by experiment. This could include: - Effect on acid-base indicators - Reaction with metals (e.g. iron, zinc, aluminium, magnesium), - Reaction with carbonates and hydrogen carbonates - Neutralizing effects on bases - As a result of these experiments students should deduce the general properties of acids.	• Lab Report • Presentation • Questions
		• Students should investigate the properties of bases by experiment. This could include: - Effect on acid-base indicators - Neutralizing effects on acids • As a result of these experiments students should deduce the general properties of alkalis.	• Lab Report • Presentation • Quiz

• Investigate household chemicals using locally prepared indicators. • In group, with guidance, prepare their own indicator by extracting the dyes from a vegetable, such as beetroot, or flowers and evaluate the indicator.	• Investigation using local indicators	• Students could make their own indicator by extracting the colour from a vegetable, such as beetroot, or flowers. They could discuss the characteristics of a good indicator and evaluate their own indicator. • In group, with guidance students could investigate house old chemicals such as vinegar, baking soda, lemon etc. using locally prepared indicators and report to the class.	• Performance assessment- • Observing while doing actives. • Report
• Describe the safety precautions while working with acids and bases. • Create a safety booklet dealing with the handling of acids and alkali.	• Precautions in working with acids and bases	• Students should be aware of the corrosive nature of both acids and alkalis and take suitable precautions when working with them. In groups, they should conduct using internet or/and others sources of information research and develop a safety booklet on the correct ways of handling acids and alkalis.	• Performance assessment-safety booklet

• Define neutralization • Identify some everyday uses of neutralization	3.4 . Neutralization Reaction and Salts (4 periods) • Neutralization	• Students could research and identify important uses of neutralization in daily life. These could include: • Neutralization at Home • Toothpaste contains bases that neutralize the acid produced by bacteria in our mouth. • Baking powder is usually used to help the cakes rise. • Conditioner is used with shampoo to prevent small scales on hair which make you hair unmanageable. • Neutralization in Health • Antacids contains bases such as aluminium hydroxide, $Al(OH)_3$ and magnesium hydroxide, $Mg(OH)_2$ to neutralize the excess acid in the stomach. • Vinegar is used to cure wasp stings that are alkaline in nature. • Baking powder is used to cure bee stings and ant bites that are acidic in nature. • Neutralization in Agriculture • Acidic soil is treated with powdered lime, CaO, limestone, $CaCO_3$ or ashes of burnt wood. • The acidic gas from the decomposition of compost neutralizes the alkalis in basic soil. • Students should be aware that different crops require different nutrients in different proportions and, as a consequence, each crop grows best in soil within a particular pH range. Students could find (from any information sources magazine, books, internet etc) the best pH range for growing different crops e.g.: • Potatoes 5.5 – 6.5	• Presentation • Report • Interview

• Conduct investigation using vinegar to dissolve baking soda as an example of neutralization		– Oats 5.5 – 7.0 – Beans 6.0 – 7.5 - Students should understand that when organic materials, such as dead leaves, animal wastes etc. decay, organic acids are produced and these lower the pH of the soil so, over the years, soil naturally becomes more acidic. – Students could check acidity and alkality of different soil samples taken from different locations. – Students should appreciate that in order to prepare the soil to produce good yields of crops, it is often necessary to raise the pH by spreading lime in the form of limestone, quick lime or slaked lime. – Students should appreciate that different amounts are needed to reduce the pH of different types of soil. • Students could create a print or digital display to exhibit the use of neutralization reactions in daily live. • Students could perform laboratory investigations on common neutralization reactions in the home (e.g., reacting baking powder and lemon juice). Report findings (using simple scientific language, drawings, labelled diagrams, bar charts or tables).	
Define and give examples of salts	• Salts	• Students could brainstorm to come out with the meaning of salt. • Students should appreciate that in science the term ‗salt' applies to a group of compounds. In order to avoid confusion common salt should be referred to as table salt and not just salt. • Students should be asked to give examples of some common salts. These could include: - Sodium chloride (table salt)	• Chapter Test • Written Assessment

		- Sodium bicarbonate - Calcium carbonate - Diammonium phosphate - Potassium nitrate	
• Name some common salts • Write formulas for some common salts using the periodic table, a list of ions, and rules for naming salts.	• Naming and Writing Formula of Salts	• Students could be asked to name and write formulas for some common salts using the given periodic table, a list of ions, and rules for naming salts, . sulphur, iron, oxygen etc. .Do not attempt to explain the Periodic Table at this stage; this will be discussed and explained in detail in Grade 9	• Observing during activity
• List some uses of common salts	Uses	Students should research the important uses of particular salts. from information sources such as reference books or from internet. These could include uses of : - Sodium chloride - Sodium bicarbonate - Potassium nitrate · Students could prepare a five -minute presentation on the uses of important salts	

Unit Four: Human Body Systems and Health (30 periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Discuss the major organs that constitute the human body systems covered in this unit
- Explain the main functions of the major human body systems covered in this unit
- Elaborate the main diseases or disorders associated with the major human body systems covered in this unit
- Discuss the effects of diseases of the major human body systems covered in this unit

Competencies	Contents	Learning Strategies	Assessment
• Distinguish the major structural components of human integumentary system	4.1 Integumentary system (4 periods) 4.1.1 Components of integumentary system	• Display a chart of human integumentary system in a class room, tell students that this is a system that covers and protects the entire human body. Then, engage students in groups of five to identify and name as many organs as possible that form the system, and allow them to make presentations of their discussions; provide comments on the gaps of their responses	• Observe students while they are discussing about identifying organs that form the system from the provided chart and make sure that all students are engaged in the group discussion and activities

• Describe the main functions of human integumentary system • Identify and discuss the main diseases or disorders and effects of human integumentary system	4.1.2 Functions of integumentary system 4.2.2 Major skin diseases and prevention (Acne, Cold sore, Blister, Hives, Actinic keratosis, Rosacea, Carbuncle, Latex allergy, Eczema, Wart, Chickenpox)	• Then, engage students to identify the outer layer (epidermis) and inner layer (endodermis) of a skin, the outer (shaft) and inner (root) part of hair, sweat gland and its duct (a tube connecting the gland to the pore on the skin surface), sebaceous gland and its duct; then, based on the students' responses, give summary of the basic structural parts and functions of each organ constituting the system • Now, ask students to tell the functions of each organ forming the integumentary system; then, give your own conclusion based on the students' responses. • Organize students into groups and ask them to discuss and list as many skin diseases as possible they know from their personal experienced how to prevent (a list of any skin disease is acceptable just to brainstorm students on the topic); allow them to make presentations of their discussions in the class. In case of large class size, the teacher can manage the presentations by letting all students prepare a presentation, but only some randomly selected individuals present on each topic. Finally, give your own conclusion based on the students' responses.	• Record the results of the students' presentations on identifying the organs of the system provided in the chart. • Provide constructive comments on the gaps observed in the students' presentations. • Ask students to differentiate the different structural parts of each organ forming the integumentary system • Ask students to differentiate the different structural parts of each organ forming the system • Question and answer on the functions of each of the organs forming the system and the function of the system as a whole. • Give students an assignment in groups of five to summarize the main diseases or disorders of skin, and submit. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

• Distinguish the major structural components of human muscular system • Describe the main functions of human muscular system • Identify and discuss the main diseases or disorders and effects of human muscular system	4.2 Muscular system (4 periods) 4.2.1Components of muscular system 4.2.2Functions of muscular system 4.2.3 Major muscle disorders (Muscle dystrophy)	• Display a chart of human muscular system in a class room, tell students that this is a system that allows movement of part of a body, the whole body or fluids such as blood via a blood vessel. • Then, engage students in groups of five to identify and name as many muscles as possible that form the system, and allow them to make presentations of their discussions; provide comments on the gaps of their responses • Help the students to recall their lesson in Grade 7 about the structure and function of cells, and engage them to identify special property of muscle cell that allows movement; then, based on the students' responses, give your conclusion based on the students' responses. • Briefly explain to the students about the three types of muscle tissues in human body (skeletal muscle, smooth muscle and cardiac muscle), with their locations and functions; to this effect you could ask students to feel their own arm and leg muscles as they extend (relax) and flex (contract) them. • Organize students into groups and ask them to discuss and mention any muscle disease they know from their personal experience (such as muscle strains, muscle dystrophy, etc.);	• Observe students while they are discussing about identifying various muscles types that form the system from the provided chart and make sure that all students are engaged in the group discussion and activities • Record the results of the students' presentations on identifying the muscles. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the types of muscle tissues and their functions. • Give students an assignment in groups of five to compare and summarize the three types of muscle tissues, and submit. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

		allow them to make presentations of their discussions in the class. Finally, give your own conclusion based on the students' responses.	
• Distinguish the major structural components of human skeletal system • Describe the main functions of human skeletal system • Identify and discuss the main diseases or disorders and effects of human skeletal system • Demonstrate on how skeletal system function by using model	**4.3 Skeletal System**(4 periods) 4.3.1 Structural components of Skeletal system 4.3.2 Functions of Skeletal system 4.3.3 Major diseases of Skeletal system (e.g. Osteoporosis, Osteoarthritis and Fracture)	• Display a chart of human skeletal system or its model in a class room, tell students that this is a system that supports our flesh or soft tissue giving us an erect posture as well as protection of major organs. • Then, engage students in groups of five to observe and record labelled bones of the various major body parts such as head, thorax, vertebral column/ backbone, upper extremity/hand, and lower extremity/leg, and ask them to count and report bones in these major body parts • Allow the students to make presentations of their discussions on the number of bones in the various body parts; provide comments on the gaps of their responses • Ask students during which stage of development (childhood or adult stage) that we tend to have less total number of bones, and reason out why.	• Observe students while they are discussing and counting bones found in the mentioned major body parts from the provided chart and make sure that all students are engaged in the group discussion and activities • Record the results of the students' presentations on the number of bones in the major body parts. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the roles of major bones in the body (such as femur, tibia and fibula, and bones of vertebral column). • Give students an assignment in groups of five to summarize the main diseases or disorders of skeletal system, and submit. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

		• Demonstrate clearly to the students from chart or diagram humerus (a bone of upper arm), radius and ulna (bones of lower arm), femur (a bone of thigh), and tibia and fibula (bones of leg). • Ask students to discuss in groups and report on the roles of the bones of the lower extremities (femur, tibia and fibula) and bones of vertebral column; then, based on the students' responses, give your conclusion. • Ask students why joints are important at articulations of two or more bones; then, based on the students' responses, give your conclusion by relating this to the antagonistic muscles at the elbow or knee joint. • Organize students into groups and ask them to discuss and list as many skeletal system diseases as possible they know from their personal experience (e.g.Bone fracture); allow them to make presentations of their discussions in the class. Finally, give your own conclusion based on the students' responses.	
• Distinguish the major structural components of human digestive system • Identify the main regions of the alimentary canal and associated organs. • Explain the type and function of teeth.	**4.4 Digestive system**(5 periods) 4.4.1 Structural components of Digestive system 4.4.2 Functions of Digestive system 4.4.3 Major diseases of Digestive system (e.g.	• Display a chart of human digestive system or its model in a class room, tell students that this is a system that plays a role in the digestion of a food that we eat. • Then, engage students in groups of five to observe and record various labelled parts of alimentary canal including mouth, pharynx (throat), esophagus, stomach, small intestine, large intestine and anal opening.	• Observe students while they are discussing and recording various labelled parts of alimentary canal, observe and identify each other's teeth; make sure that all students are engaged in the group discussion and activities

• Describe the main functions of human digestive system • Identify and discuss the main diseases or disorders and effects of human digestive system	Constipation, Hemorrhoids, Peptic Ulcer Disease (PUD), Gastritis, and Diarrhea caused by amoebic or helminthic infections)	• Give students an impression of the movement of a food we eat through the alimentary canal from mouth to anal opening while they make an observation. • Ask students to look at each other's teeth and tell the types, numbers and roles of their teeth. • Allow the students to make presentations of their discussions on the various parts of alimentary canal as well as types, numbers and roles of teeth; provide comments on the gaps of their responses. • Brainstorm students on how food moves and what moves it through the alimentary canal; here you can demonstrate the process of the food movement through muscle contraction at each part of alimentary canal by using a stocking or tight to represent the alimentary canal, and any round object such as an intact egg to represent a bolus of food in the alimentary canal. • Once, the students have finished their observations and presentations on the major parts of alimentary canal and teeth, ask them to observe and record the major organs, such as liver and pancreas, which are found in close association with the alimentary canal.	• Record the results of the students' presentations on the alimentary canal and teeth. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the roles of teeth. • Question and answer on the examples of digestion end products, and where they go next • Question and answer on what a faeces is in human digestion. • Give students an assignment to draw a diagram of human alimentary canal, label with the major parts, and submit individually • Give students an assignment in groups of five to summarize the main diseases or disorders of digestive system, and submit. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

		• Ask students if they think that these organs have roles in food digestion. • Now, briefly introduce students to the concept that food is digested physically in the mouth by the help of teeth and then in the stomach by the help of stomach muscle. Then, go on explaining that food is also digested chemically by the action of chemical substances known as enzymes that are released into various sections of alimentary canal. Relate this role to liver and pancreas that release enzymes into small intestine for chemical digestion of food. • Ask students to discuss what the end products and wastes of a digested food are. Reflect on the students' answers by explaining to them that when food is completely digested it is converted into usable forms that then enter blood vessels. For instance, digestion end products of bread (carbohydrate) are glucose, meat (protein) are amino acids, and butter (fat) are fatty acids and glycerol. Undigested food material is excreted as faeces (waste matter) from alimentary canal via the anal opening. • Organize students into groups and ask them to discuss and list as many digestive system diseases as possible they know from their personal experience; allow them to make presentations of their discussions in the class. Finally, give your own conclusion based on the students' responses.	

		• Provide a library work or search from internet on the various diseases or disorders associated with digestive system and then the student present in the class	
• Distinguish the major structural components of human respiratory system • Demonstrate the presence of carbon dioxide in exhaled air using lime water. • Demonstrate the presence pf moisture in exhaled air by simply breathing out over a polished mirror • Describe the main functions of human respiratory system • Identify and discuss the main diseases or disorders and effects of human respiratory system • Demonstrate the model of lung using balloon	**4.5 Respiratory system**(5 periods) 4.5.1 Structural components of Respiratory system 4.5.2 Functions of Respiratory system 4.5.3 Major diseases of Respiratory system (Asthma, Sinusitis, Influenza, Chronic obstructive pulmonary disease, bronchitis)	• Display a chart of human respiratory system or its model in a class room, tell students that this is a system that plays a role in the breathing in (inhalation) of fresh air (with plenty of oxygen) and breathing out (exhalation) of waste air (with plenty of carbon dioxide). • Then, engage students in groups of five to observe and record various labelled parts of respiratory tract including nasal openings, nasal chamber, trachea, lungs (with bronchi and bronchioles), air sacs (alveoli). • Give students an impression of the flow of air we breathe in through the respiratory tract from nasal opening to alveoli while they make an observation; give sketch of the route of air flow in and out. • Allow students to make presentations of their discussions	• Observe students while they are discussing and recording various labelled parts of respiratory tract; make sure that all students are engaged in the group discussion and activities • Record the results of the students' presentations on the respiratory tract and teeth. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the roles of major structural parts of the respiratory tract. • Question and answer on the route of air from nostrils (nasal openings) to air sac (alveoli). • Question and answer on why the atmospheric air and exhaled air vary in their(oxygen ,carbon dioxide and water vapor) • Performance assessment on the demonstration of laboratory experiment

		on the various parts of respiratory system; provide comments on the gaps of their responses. • Once, the students have finished their observations and presentations on listing the major parts of respiratory tract, ask them to discuss on the roles of (a) hairs in the nasal cavity, (b) cartilaginous rings in the structure of trachea, (c) alveoli • Organize students into groups and ask them to discuss and list as many respiratory system diseases as possible they know from their personal experience; allow them to make presentations of their discussions in the class. Finally, give your own conclusion based on the students' responses.	• Give students an assignment to draw a diagram of human respiratory tract, label with the major parts, and submit it individually. • Give students an assignment in groups of five to write a short summary on how smoking affects our respiratory system, and hence should discuss bronchitis somehow. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.
• Distinguish the major structural components of human circulatory system • Describe the main functions of human circulatory system • Discuss the structure and function of mammalian heart.	**4.6 Circulatory system**(4 periods) 4.6.1 Components of Circulatory system **Blood vessels** -Artery -Vein - Capillaries their structure and function **Blood** -RBC -Platelet -WBC -Plasma 4.6.2 Functions of Circulatory system	• Display a chart of human circulatory system or its model in a class room, tell students that this is a system that plays a role in the distribution of essential materials such as food and oxygen to various body parts. • Then, engage students in groups of five to observe and record various labelled parts of circulatory system including blood, blood vessels and heart.	• Observe students while they are discussing and recording various labelled parts of circulatory system; make sure that all students are engaged in the group discussion and activities • Record the results of the students' presentations on the circulatory system.

• List the components and functions of blood as red blood cells, white blood cells, platelets and plasma • Identify and discuss the main diseases or disorders and effects of human circulatory system 4.6.3. Major diseases of Circulatory system (High blood pressure, Heart attack, Heart failure, Strokes, Anemia,HIV) and their prevention means.	• Give students an impression of the circulatory circuit i.e. the route of blood flow between heart and various body parts connected by blood vessels. • Now, allow students to make presentations of their discussions on the various parts of circulatory system; provide comments on the gaps of their responses. • Provide a model of heart to students in groups of five and ask them to make observation on the various heart chambers; ask students to quantify the number of chambers and hypothesize why heart is partitioned into chambers; supervise the students' discussions and reflect on their responses. • Provide a chart that depicts the three major categories of blood vessels (arteries, veins and capillaries), and ask them to discuss on their roles (hint the students to relate the positioning of the blood vessels relative to heart); supervise the students' discussions and reflect on their responses. • Provide a chart that depicts plasma (liquid component of blood) and the three major categories of blood cells (red blood cells, white blood cells and platelets), ask them to observe and record any differences among the blood cells in terms of color, shape, size, etc.; also ask them to discuss on what the roles of each of these blood cells might be; supervise the students' discussions and reflect on their responses.	• Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the roles of major structural parts of the circulatory system. Give students an assignment to draw a diagram double circuit in human blood circulation, label the major parts, and submit it individually. • Give students an assignment in groups of five to summarize the main diseases associated with the human circulatory system, and submit it. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

• Distinguish the major structural components of human reproductive system • State the structure and function of the parts of the male reproductive system • State the structure and function of the parts of the fe male reproductive system • Distinguish between the primary and secondary sexual characteristics • Discuss the process of menstrual cycle	4.7 Reproductive System(4 period) 4.7.1. Male reproductive system 4.7.2 Female reproductive system 4.7.3 Primary and secondary sexual characteristics 4.7.4 Menstrual cycle Management of menstrual hygiene 4.7.5 Fertilization, pregnancy and birth 4.7.6 Methods of contraception	• Organize students into groups of five, and pose each group to discuss on the following questions and make presentations in the class: (1) what is the role of heart in blood circulation, (2) what is the role of blood vessels in blood circulation, (3) what are the roles of each of the three types of blood cells, (4) provide a diagram/chart of human blood circulation, and ask them to reason out why the blood flows in two circuits. • Organize students into groups and ask them to discuss and list as many circulatory system diseases as possible they know from their personal experience; allow them to make presentations of their discussions in the class. Finally, give your own conclusion based on the students' responses. • Categorize the students into groups of five, and engage them in a discussion on the importance of reproduction in humans as well as in other organisms; then allow students to make presentations of their discussions. • Then, briefly explain to the students the distinctions between the primary and secondary sexual characteristics with examples • Now, display a chart of human	• Observe students while they are discussing and recording importance of reproduction in human and other organisms, various labelled parts of reproductive system and their roles; make sure that all students are engaged in the group discussion and activities • Record the results of the students' presentations. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer (a) on the roles

• Explain how fertilization takes place in human • Describe pregnancy and birth • Describe the various methods of contraception • Describe the main functions of human reproductive system • Identify and discuss the main diseases or disorders associated with human reproductive system	4.6.7 Harmful traditionalpractice e.g FGM 4.6.8 Diseases of reproductive system(syphilis, gonorrhoea, cancroids, cervical cancer,HIV/AIDS)	reproductive system or its model (of both male and female) in a class room and engage them in groups to observe and record the various labelled parts of reproductive system testis, vas deferens and penis in males, and vagina, uterus and ovary in females; students should create the list of these major organs in a table and try to discuss on the roles of each in the reproduction process • Then, allow students to make presentations of their discussions on the various parts of reproductive system; provide comments on the gaps of their responses. • Organize students into groups of five, and ask them to discuss and provide as many examples of physical (bodily) changes(i.e. secondary sexual characteristics) as possible that are observed during ones sexual maturity (puberty); students should compare and contrast these changes between males and females. • Organize students into groups and discuss on the concept of menstruation and menstrual cycle • Organize students into groups and ask them to discuss and list as many reproductive system diseases as possible they know from their personal experience; allow them to make presentations of their discussions in the class. Finally, give your own conclusion based on the students' responses (focus on sexually transmitted diseases such as Syphilis, Gonorrhea, Chancroid, and HIV/AIDS-partly).	of major structural parts of the reproductive system, (b) characteristic changes during sexual maturity (puberty). • Give students an assignment to draw a diagram of human reproductive systems, for both males and females, labelled with major parts such as scrotum, vas deferens and penis (in males), vagina, uterus and ovary (in females), and submit it individually. • Give students an assignment to the students to discuss with their parents on the necessary cares that should be taken during menstruation, and report to the teacher. • Give students an assignment in groups of five to summarize the sexually transmitted diseases associated with the human reproductive system, and submit it. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

Unit Five: Ecosystem and Conservation of Natural Resources (33 periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Define ecosystem and components of ecosystem
- Identify and describe the types of biological interactions of organisms in an ecosystem
- Construct simple food chain and explain its components
- Differentiate between food chain and food web
- Distinguish between the different components of food chain
- Describe the role of nutrient recycling in nature
- Explain how energy flows from producers to consumers
- Explain why nutrients are said to recycle while energy flows (does not recycle)
- Summarize the characteristics of soil
- Describe the various types of soils
- Explain the various uses of soil in nature and to human being
- Summarize the characteristics and uses of soil.
- List down and describe the various soil conservation strategies
- Engage in the Environment Club of School and participate in awareness creation campaigns.
- Explain the various uses of soil in nature and to human being
- List down and describe the various water conservation strategies
- Describe the various components of atmospheric air
- Identify and discuss the various human activities that cause air pollution

- Discuss the impacts of air pollution with examples
- Explain the various uses of air in nature and to human being
- Explain the cause and impacts of global warming
- List down and describe the various actions that can be taken to reduce the emission of carbon dioxide to atmosphere
- Define forest and give examples of natural forests in Ethiopia
- Explain the various uses of forest in nature and to human being
- Identify and discuss the various human activities that cause deforestation
- Discuss the impacts of air pollution with examples
- Devise and coordinate various forest conservation actions
- Organize groups that would campaign to teach the community on environmental protection
- Organize plantation campaigns in their school compound and its environs
- List and describe the values of biodiversity
- List down and describe the various in-situ and ex-situ conservation strategies in biodiversity conservation
- Give examples of the various indigenous knowledge and practices that are used in the conservation of various natural resources such as soil, forest, etc.

Competencies	Contents	Learning Strategies	Assessment
• Define ecosystem and components of ecosystem • Identify and describe the types of biological interactions of organisms in an ecosystem • Construct simple food chain and explain its components • Differentiate between food chain and food web • Distinguish between the different components of food chain • Interpret food chains and food webs in terms of identifying producers and consumers • Describe the role of nutrient recycling in nature	**5.1 Ecosystem and Interactions** (11 periods) 5.1.1 Definition and Components of ecosystem (biological and physical) 5.1.2 Types of biological interactions 5.1.3 Trophic (feeding) level and relationships - Primary trophic level/ producers - Secondary trophic level / consumers - Tertiary trophic level/ consumers 5.1.4 Food chain and food web	• Provide students with a labelled chart that depicts communities of organisms, their habitats, conditions in their environment in general, and tell them that the chart depicts an ecosystem; this should allow students to compare their local ecosystem with a contrasting one, either from Ethiopia or globally. • Then, engage students in groups to observe the chart, discuss and reflect how they understand an ecosystem; supervise the students' discussions and reflect on their responses. • While students are still in	• Observe students while they are participating in group discussions and record their performances. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the components of an ecosystem, similarities and differences among the various forms of biological interactions. • Give students an assignment to draw a diagram of trophic pyramid, label it with the major components, and submit it individually.

• Explain how energy flows from producers to consumers • Explain why nutrients are said to recycle while energy flows (does not recycle)	5.1.5 Components of food chain (producers, consumers, decomposers) 5.1.6 Trophic pyramids -Pyramid of number -Pyramid of biomas -Pyramid of energy 5.1.7 Nutrient cycles and energy flow	groups, ask them to categorise the components of ecosystem as biological (living) and physical (non-living); supervise the students' discussions and reflect on their responses. • Then, briefly summarize the various forms of biological interactions that exist among various groups of organisms in an ecosystem (such as mutualism, commensalism, amensalism, competition, and parasitism and stress on the need for interaction among organisms of similar and/or different species and also with their physical environment. • Now, provide students with charts of food chain and food web, and briefly explain to them that both diagrams represent trophic (feeding) relationships of living things (organisms); then, ask students to discuss in groups to find out the differences between food chain and food web; supervise the students' discussions and reflect on their responses. • Then, ask students to identify the major components of food chain as producers (autotrophs), consumers (heterotrophs) and decomposers; reflect on the students' responses. • Briefly explain to the students the roles of each component in the food chain/food web. Remind your students to recall	• Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

		their knowledge on photosynthesis (Unit 4; Grade 7) to relate to the roles of producers (such as green plants). • Provide a chart of trophic pyramid (that consists of producers to tertiary consumers) to the students in groups of five, and ask them to discuss and reason out why the number of organisms in each group (level) decreases from bottom to top. • Invite students to make presentations on the trophic pyramid; reflect on their responses after all the groups have finished their presentations. • Briefly explain to students the roles of trophic relationships in nutrient cycling and energy flow. • Then, ask students to explain how nutrients such as carbon, hydrogen, oxygen and nitrogen contained in food materials eventually return into the environment (hint relate to the role of decomposers such as bacteria and fungi). • Also ask students how trophic relationships help energy flow in an ecosystem and reason out why energy is said to flow but not cycles in nature (hint, recall that energy in trophic relationship originates from the sun, which will not get the energy back). • Briefly summarize for students how nutrient cycling and energy flow in an ecosystem help continuity of life in nature.	

• Summarize the characteristics of soil • Describe the various types of soils • Explain the various uses of soil in nature and to human being • List down and describe the various soil conservation strategies • Engage in the Environment Club of School and participate in awareness creation campaigns.	**5.2 Conservation of Natural Resources** (21 periods) **5.2.1 Soil** Definition and characteristics; types of soils uses of soil; soil fertility and soil conservation strategies	• Provide students with samples of various types of soil (clay, sand and loam soils) in polyethylene bags, and ask them to observe the soil samples and record their differences in color, granule or particle size, etc.; also ask them to name the soil samples as they might know them locally. • Briefly explain to the students how a soil can be defined, and how it is formed. • Then, encourage students to summarize their answers on the group activities above, and make presentations turn by turn; provide comments on the gaps of their responses. • Create a setup to demonstrate to students which soil sample passes quickly water through it and which one tends to hold more water, and which soil sample tends to have an intermediate capacity of holding or retaining water. • Now, ask students to guess which of the three soil samples you provided to them tends to be more fertile i.e. contains nutrients important for plant growth, and reason out why.	• Observe students while they are participating in group discussions and record their performances. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the soil types and their differences in characteristics (such as color, granule or particle size), fertility, uses to human and in nature. • Question and answer on the various soil conservation strategies. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

		• Briefly summarize on the characteristics and uses of each of the three soil types, functions of soil overall. • Brainstorm interactively students on the factors that could lead to loss of soil fertility, and what conservation measures could be taken to counteract those factors • Encourage them to participate in environmental protection clubs; also organize students in groups of five and ask them to identify a suitable plot of land in their school compound (a garden) where they will be required to plant indigenous plants and provide continuous care.	
• Explain the various uses of water in nature and to human being • List down and describe the various water conservation strategies	**5.2.2 Water** • Uses of water; water conservation strategies (harvesting rainwater, protection of ground water resources, sustainable utilization of groundwater resources; education outreach; water conservation day-22nd March)	• Organize students into groups and ask them to discuss in detail on the various uses of water to human, plants, animals, etc. • Allow students to make presentations of their discussions on the various uses of water; provide comments on the gaps of their responses. • Inspire students by showing them from a world map that 75% of the Earth is water but the vast majority of which is salty and not palatable for human consumption. Continue explaining to them that only the freshwater in the streams and rivers are used for the daily human life functions.	• Observe students while they are participating in group discussions and record their performances. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the water conservation, water polluting factors and water conservation strategies.

		• Now, ask students to discuss in groups human activities that could cause pollution of water, and the impacts of the pollution. • Allow students to make presentations of their discussions on the various human activities that cause pollution of water; provide comments on the gaps of their responses. • Then, discuss with students interactively what conservation strategies could be used to counteract water pollution and ensure sustainable use of water. Inform students of the –Water conservation day‖, celebrated 22nd March every year and its main purpose.	• Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning. • Give students an assignment in groups of five to search for the –Water conservation Day‖ from the Internet, browse information about its goals and the purpose of the observing the Day, and submit it individually.
• Describe the various components of atmospheric air • Identify and discuss the various human activities that cause air pollution • Discuss the impacts of air pollution with examples	**5.2.3 Air** • Air composition and its uses; air pollution and its impacts	• Briefly introduce to the students about the composition of atmospheric air. • Then, in groups of five, encourage students to discuss on uses of air to human, animals, and plants; provide comments on the gaps of their responses. • Now, ask students to discuss in groups human activities that could cause pollution of air, and the impacts of the pollution (such as global warming, acid rain and particulate pollutants). • Allow students to make presentations of their discussions on the various human activities that cause air pollution; provide comments on the gaps of their responses.	• Observe students while they are participating in group discussions and record their performances. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the composition of atmospheric air, air polluting factors and strategies to reduce air pollution.

• Explain the various uses of air in nature and to human being • Explain the cause and impacts of global warming • List down and describe the various actions that can be taken to reduce the emission of carbon dioxide to atmosphere		• Briefly explain to students how the release of carbon dioxide (CO_2) from various sources (such as fuel burning from vehicles and factory smokes) can cause global warming and the potential consequences of global warming on the environment in general. Also explain how the release of hydrogen sulphide (H_2S) from coal mining would lead to acid rain its potential consequences. • Now ask students, to discuss in groups how tree plantation could help reduce the amount of carbon dioxide emitted into the air, and thus reduce global warming (Hint: refresh your students on photosynthesis in Unit 4, and tell them to relate this question to the process of photosynthesis). • Then, discuss with students interactively what other measures could be used to counteract air pollution.	• Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.
• Define forest and give examples of natural forests in Ethiopia • Explain the various uses of forest in nature and to human being	**5.2.4 Forests** • Definition, uses and conservation of forests	• Start by asking students if they know of —forest‖ and what it is; comment on their responses and gaps. • Mention some of the major forests found in Ethiopia with their location. • Continue engaging students, in groups of five, to discuss on the roles of forests in nature (including reduction of global warming) and their uses to human being.	• Observe students while they are participating in group discussions and record their performances. • Provide constructive comments on the gaps observed in the students' presentations.

• Identify and discuss the various human activities that cause deforestation • Discuss the impacts of air pollution with examples • List down and describe the various actions that can be taken to conserve forests		• Allow students to make presentations of their discussions on the roles of forests in nature and their uses to human being; provide comments on the gaps of their responses. • Then, brainstorm students on the problem of deforestation and its impacts, and then discuss with students interactively on the human activities causing deforestation, and strategies (such as afforestation, reforestation, etc.) that could be used to counteract deforestation and ensure sustainable use of forests.	• Question and answer on the uses of forests to human being and in nature, human actions that cause deforestation, and strategies for forest conservation • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.
• List and describe the values of biodiversity • List down and describe the various in-situ and ex-situ conservation strategies in biodiversity conservation	**5.2.5 Biodiversity** • Biodiversity values Biodiversity conservation strategies (in-situ and ex-situ)	• Start by refreshing students the diversity of living things in Unit 1; then, ask students to give some examples of organisms for each of the five Kingdoms. • Briefly explain to students the concept of biodiversity and ask them to discuss in groups of five what values biodiversity have to human being and in nature.	• Observe students while they are participating in group discussions and record their performances. • Provide constructive comments on the gaps observed in the students' presentations. • Question and answer on the uses of forests to human being and in nature, human actions that cause deforestation, and strategies for forest conservation

• Give examples of the various indigenous knowledge and practices that are used in the conservation of various natural resources such as soil, forest, etc.	5.2.6. Indigenous knowledge and conservation of natural resources	• Briefly introduce to students the concept of conserving biodiversity at their home or in their natural habitat (in-situ) such as national parks, wildlife sanctuaries and biosphere reserve, and in captivity (ex-situ) such as zoos, aquarium and botanical gardens. • Organize students into groups of five, and ask them to discuss with each other if they know of any example of national parks and zoos; this provide an opportunity for students to collect and interpret data from surveys about attitudes to conservation • Allow the students to make presentations of their findings	• Give students an assignment in groups to use an Internet to find information on the list of Ethiopian National parks and Zoos in Ethiopia, and submit it individually. • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.
		• Organize students into groups of five and give them a homework to ask their family or anyone they know of regarding any indigenous practices used in various regions of Ethiopia to conserve soil, water, vegetation, etc. • Ask students to summarize their reports and make presentations in the class turn by turn.	• Question and answer on the values of indigenous knowledge and practices in the conservation of soil, water and vegetation • Provide descriptive feedback on all the students' activities and the assignment work indicating how they shall improve their learning.

Unit six: The Solar System (22 Periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Understand the concept of solar system.
- Differentiate movement of planets and satellites in the solar system.
- Understand the unique characteristics of earth and planets.

Competencies	Contents	Learning Strategies	Assessment
Explain family of the solar system. • Name all planets in the solar system. • Show the position of each planet in the solar system • Develop the model of solar system.	**6.1 Family of the Solar System** (5 periods)	Allow each student to make a model of the solar system and identify - Compare earth with the solar system - Family of solar system - Suitability of earth for life	Cheek exact expression of the model and its decryption
• Describe how satellites move around the earth. • Explain the motion of large bodies in the solar system • Differentiate the motion of satellites and planets in the solar system	6.2 Formation of the Solar System (Planets & Satellites, Other objects) (6 periods)	• Based on build model make a student to discuss on - How satellites move around the earth. - motion of large bodies - Differentiate the motion of satellites and planets	• Follow the group what they discussed on
• Compare the distance, size, position and behavior of each planate from the sun	6.3 Earth in comparison with Solar system (6 periods)	• Based on build model make each student to explain the distance, size, position and behavior of each planate from the sun	• Ensure exact expression of each term
• Explain the unique characteristics of the earth. • Describe the suitability of earth for life.	6.4 Our planet's suitability for life (uniqueness) (5 periods)	• Make a student to find different unique characteristics of the earth and suitability of earth for life from different sources.	• Follow the expression of unique characteristics and suitability of earth for life

Unit Seven: Physical Phenomena in the Surrounding (22 Periods)

Learning Outcomes: At the end of this unit, learners will able to:

- Understand sources, dispersion, image formation and purpose of light.
- Know general concept of sound.
- Differentiate simple electric circuit and magnetism.
- Define the term heat

Competencies	Contents	Learning Strategies	Assessment
• List some sources of light • Describe reflection and refraction • Explain dispersion of light • Show colors formed on the other side of the prism.	7.1 Phenomena of Light (source & properties) (4 periods)	• Make a group to discuss on sources, reflection, refraction and dispersion of light • Use the prism and identify all colors formed on the either side of the prism. different	• Observe discussions and assist well. • Follow correct color identification and sequence of the color
• Determine the purpose of light • Classify materials as transparent, translucent and opaque. • Demonstrate how image is formed	7.2 Vision and Imaging (transparent, opaque) (3 periods)	• Make student to explain purpose of light • Use light torch to show classify as transparent, translucent and opaque and image formation	• Observe correct classification transparent, translucent and opaque and formation of image.
• Define sound as a form of energy • Explain how sound is formed • Demonstrate the formation of sound • Identify material medium for sound propagation. • Prioritize sound propagation in solid, liquid and gases • Explain the cause of sound pollution • Identify hearing level for different sound • List strategies of sound pollution • Define echo and demonstrate its application	7.3 Sound (Sources, medium, Hearing, Echoes, sound pollution) (4 periods)	• Give an exercise to practice how echo is formed. • Make a group and discuss on • Sound energy and its formation • Which material transfer sound more • Sound pollution	• Ask how echo is formed and individual understanding of members of the group.
• Define the term heat • Explain mechanism of heat transfer	7.4 Heat (Definition, mechanisms of transfer,	• Make students to boil a water and insert a metal	• Make sure the able to do by following the

• Classify materials as good conductors of heat and poor conductors of heat (insulators)	insulation) (4 periods)	stick in to the boiled water. Allow student to explain how heat is transferred to environment, metal stick and between molecules of the water after that define heat.	necessary stapes
• List all material used to construct simple circuit • Construct simple circuit	7.5 Simple circuit (4 periods)	• Make to construct simple circuit	• Observe construction of simple circuit
• Define magnetism • Do simple experiment and construct magnetic lines of force • Explain the use of magnet	7.6. Magnetism (Magnetic lines of force, Use) (3 periods)	. Allow student to show magnetic lines and its use	• From simple demonstration of magnetic lines of force make sure student can demonstrate magnetic lines of force

References

1. Darrel D. Ebbing, Steven D. Gammon, General Chemistry, 9th edition, 2009, Houghton Mifflin company, Boston New York.
2. Edward W. Pitzer, Introductory Chemistry, 1st edition, 2014.
3. H. Stephen Stoker, General Organic and Biological Chemistry, 5th edition, U.S.A
4. Paula Yurkanis Bruice, Organic Chemistry, 4th edition.
5. Peter Atkins, Julio de Paula, Physical Chemistry, 9th edition, 2010, W.H. Freeman and company, New York.
6. Raymond Chang, General Chemistry: the essential concepts, 3rd edition, 1988, Random House, New York.
7. Steven S. Zumdahl, Susan A. Zumdahl, Chemistry, 8th edition.
8. Anatomy and physiology books
9. By sherry Christiansen, medically reviewed by Danielle Weiss updated on march 10,2021
10. Exercise physiologist ESSA Exercise & Sports Science Australia
11. Galaxy reference series biology grade 11 and 12
12. GCSE biology
13. High school biology grade 11 and 12
14. Medical news today.com
15. Mega biology for grade 9 and 10
16. New guide to preparatory program biology
17. Third edition biological science
18. American institute for conservation (AIC)
19. Biology text book for grade 9 and 10
20. Biology text book grade 7 and 8
21. Biology reference from grade 9 to 10
22. By Brigham young university-Idaho. Anatomy and physiology
23. By The Editors of Encyclopedia Britannica Last Updated: Aug 11, 2021 | View Edit History.foundation for advancement in conservation (FAIC)

24. From International Soil and Water Conservation Research, 2015
25. Galaxy reference series biology grade 11 and 12
26. High school biology grade 9 and 10
27. Jay P. Angerer, June E. Wolfe, in Biological and Environmental Hazards, Risks, and Disasters, 2016
28. Mega biology for grade 9 and 10
29. National Geographic Headquarters1145 17th Street NW Washington, DC 20036
30. New generation biology for grade 9 and 10
31. Thomas. M. Matiasi, in Proceedings from the International Conference on Advances in Engineering and Technology, 2006
32. Ethiopian space science and technology institute
33. F.l. Verwiebe, g.e. Vanhooft and B.W.Saxon. Physics a basic science (5th ed). (1970).usa: new york, american book company.
34. J.bolemon. Physics an introduction (2nd ed). (1989) usa: new jersey englewood cliffs.
35. Jones and Marchington,. Coordinated science 2nd edition Cambridge
36. Michael Nelkon. Advanced level physics (6th ed). London: meinemann educational books ltd.
37. Wysession, Frank, Yancopulos,. Physical science concepts in action.
38. Amare Legese .etl Chemistry grade 8 textbook, 2013, Aster Nega, A.A.

Websites

1. https://www.ausetute.com.au/wriiform.htm
2. https://www.vedantu.com/question-answer/prepare-your.own-indicator-using-beetroot-class-10-chemistry-5f30ef41f22476109650eBe
3. https://www.vedant.com/chemistry/importance-of-neutralization-reaction-in-daily-life
4. https://www.endvawnow.org/en/articles/336-indicators.htm
5. https://courses.lumenlearning.com/introchem/chapter/naming-

acids-and-bases/
6. https://www.kenhub.com/en/library/anatomy/integumentary-system
7. https://www.britannica.com/science/oxygen
8. https:/www.cbd.int/ibd/2008/resources/teaching/
9. https://www.nationalgeographic.org/media/marine-food-webs/
10. https://ngss.sdcoe.net/Evidence-Based-Practices/5E-Model-of-Instruction
11. www. EBI.gov.et

General Science

Grade 8

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